PUBLIC NOTICE OF A MEETING
OF THE CITY COUNCIL OF PLEASANT VIEW CITY, UTAH

December 8, 2015

Public Notice is hereby given that the City Council of Pleasant View, Utah will hold a Public Meeting in the city office at 520 West Elberta Dr. in Pleasant View, Utah on Tuesday, December 8, 2015, commencing at 5:00 P.M.

The agenda consists of the following:

5:00 P.M. 1. Presentation on Water System Source and Storage Feasibility Analysis.
(Presenter: Cliff Linford, Sunrise Engineering)

Adjournment

The City Council at their discretion may change the order and times of the agenda items.

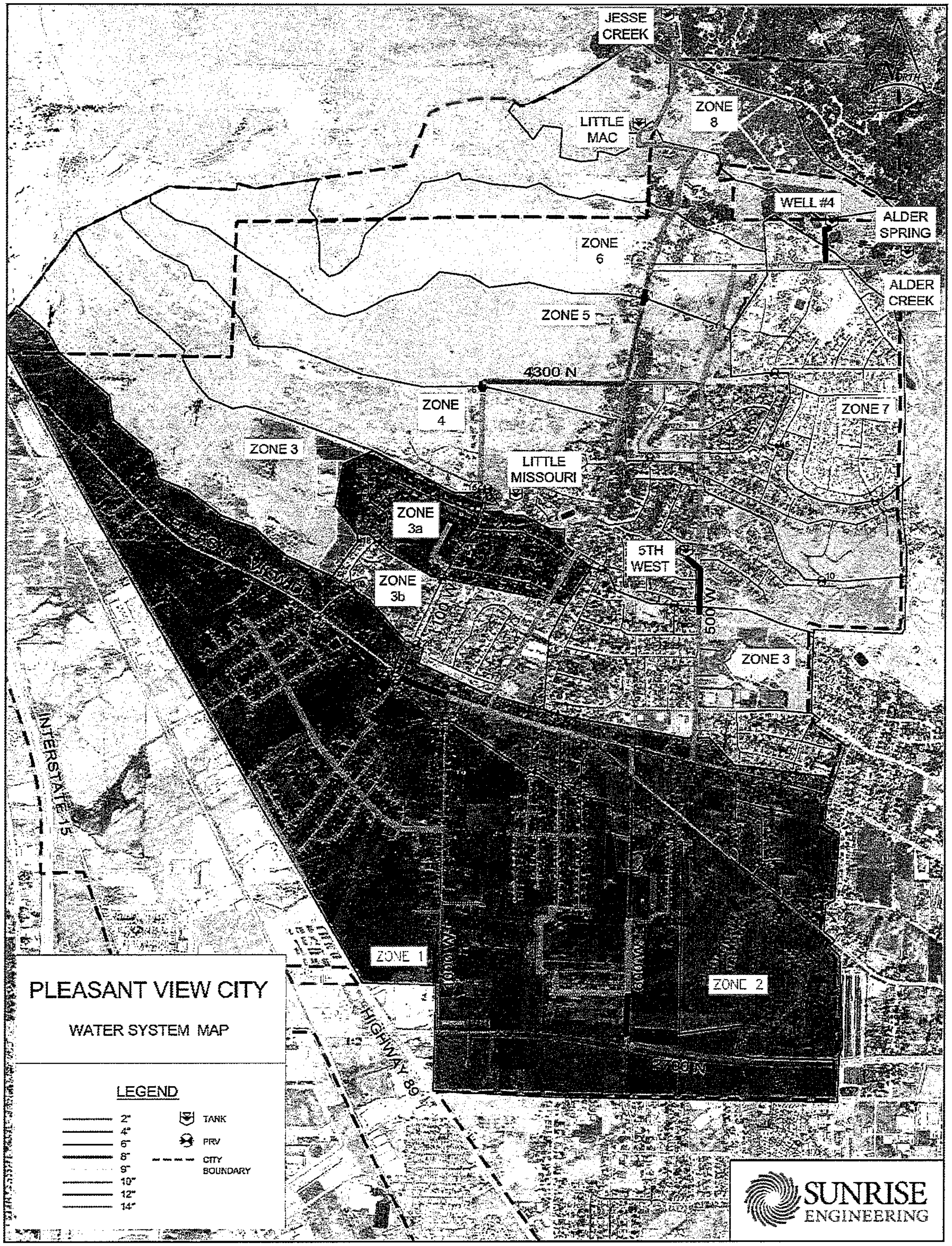
In compliance with the Americans with Disabilities Act, persons needing auxiliary services for these meetings should call the Pleasant View City Office at 801-782-8529, at least 24 hours prior to the meeting.

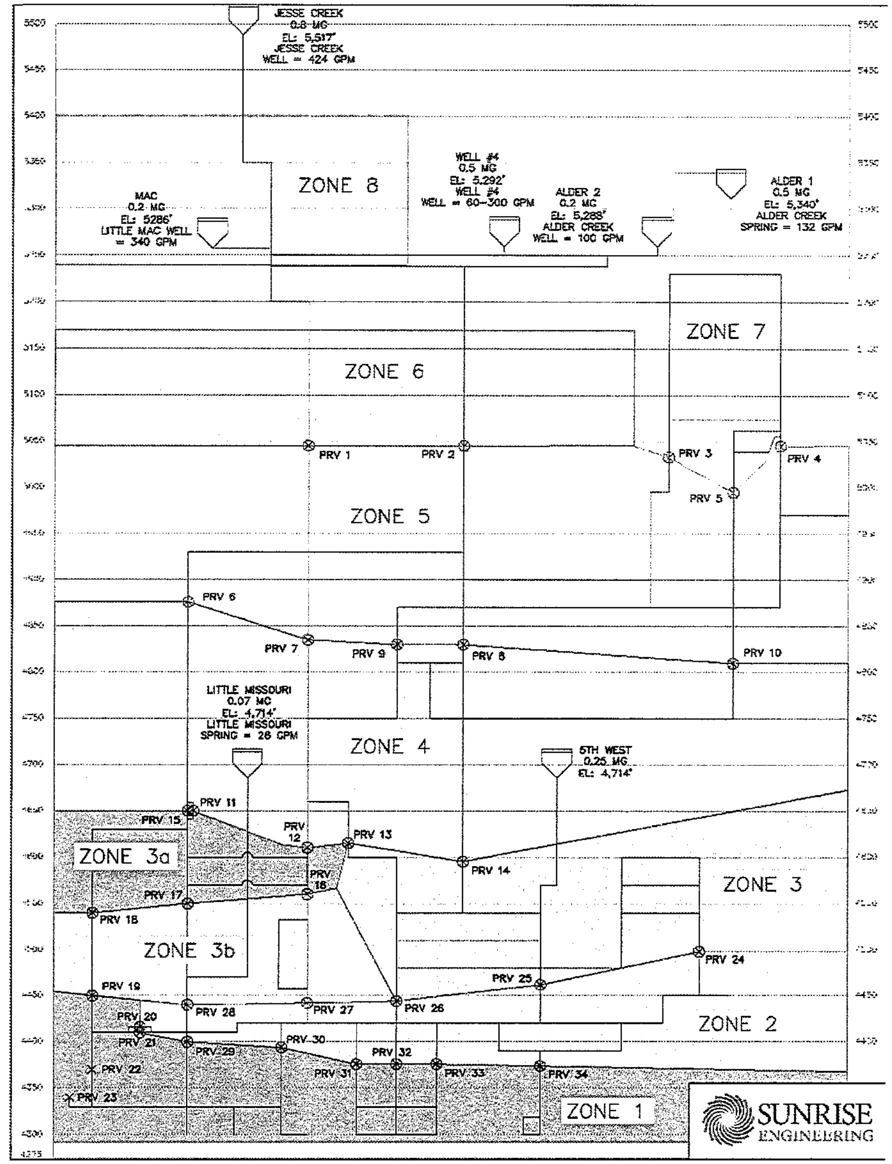
SUNRISE ENGINEERING

Pleasant View City Source & Storage Feasibility Study

Purpose

- Basic Understanding of Water System
- Existing Connections & Build Out Connections
- Existing Source & Storage Capacity
- Provide a Feasibility Assessment on Future Source Options.





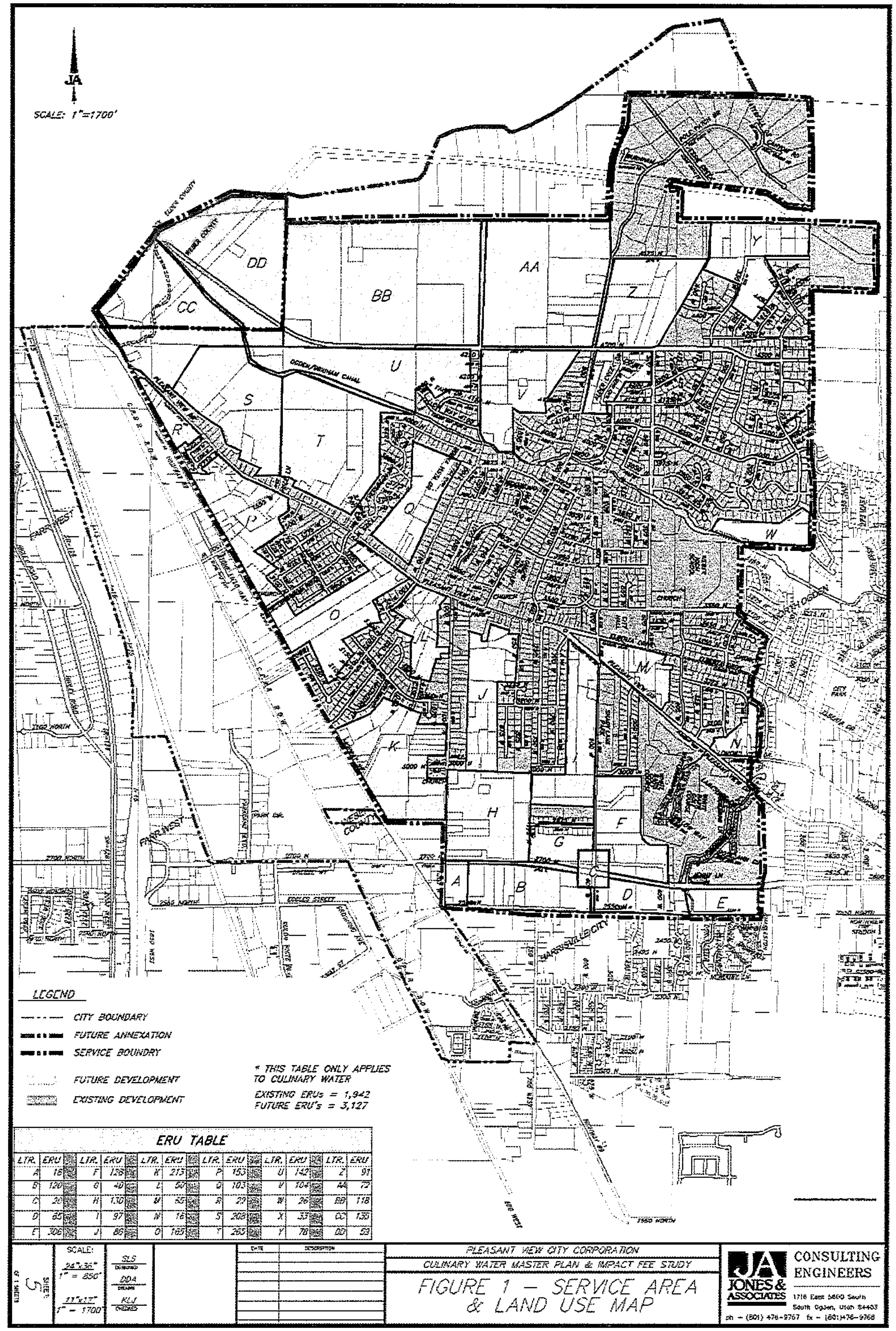
reating solutions that work and relationships that last.

Existing System Connections

2,158 Connections & 332 Additional Approved Undeveloped Lots – 2,480 Connections

Zone	Existing Connections
8	26
7	9
6	210
5	179
4	252
3	252
3a	145
3b	114
2	306
1	665
Pleasant View City	**2,158**

ERCs Build Out Map



ERU TABLE

LTR.	ERU	LTR.	ERU	LTR.	ERU	LTR.	ERU	LTR.	ERU	LTR.	ERU
A	18	F	128	K	213	P	153	U	142	Z	91
B	120	G	40	L	50	Q	103	V	104	AA	72
C	20	H	130	M	55	R	29	W	26	BB	118
D	65	I	97	N	16	S	208	X	33	CC	135
E	306	J	86	O	165	T	265	Y	78	DD	53

sunrise-eng.com

Culinary Water System – Build Out

Zone	Lot Size (SF)	Lot Size (AC)	ERC/AC
RE20	20,000	0.46	1.74
RE15	15,000	0.34	2.32
A-2	87,120	2.00	0.45
A-5	217,800	5.00	0.18
CP-1	20,000	0.46	1.74
CP-2	20,000	0.46	1.52
CP-3	20,000	0.46	1.52

Culinary Water System – Build Out

Zone	Existing Connections	Future Connections	Build Out Connections
8	26	14	40
7	9	93	102
6	210	50	260
5	179	81	260
4	252	273	525
3	252	350	602
3a	145	-	145
3b	114	-	114
2	306	56	362
1	665	666	1,331
Pleasant View City	**2,158**	**1,583**	**3,741**

Source Demands

- Average Yearly Demand is defined as the source capacity to provide one year's supply of water.
- Peak Day Demand is defined as the anticipated water demand on the day of highest water consumption

Pleasant View City Average Day Demand

- Existing System

Minimum Source Requirement	Ave. Demand (GPM)	Ave. Yearly Demand (MG)	Ave. Yearly Demand (AC-FT)
Existing (DDW)	606	319	978

- Existing System with Approved Lots

Minimum Source Requirement	Ave. Demand (GPM)	Ave. Yearly Demand (MG)	Ave. Yearly Demand (AC-FT)
Existing (DDW)	696	366	1,122

Pleasant View City Peak Day Demand

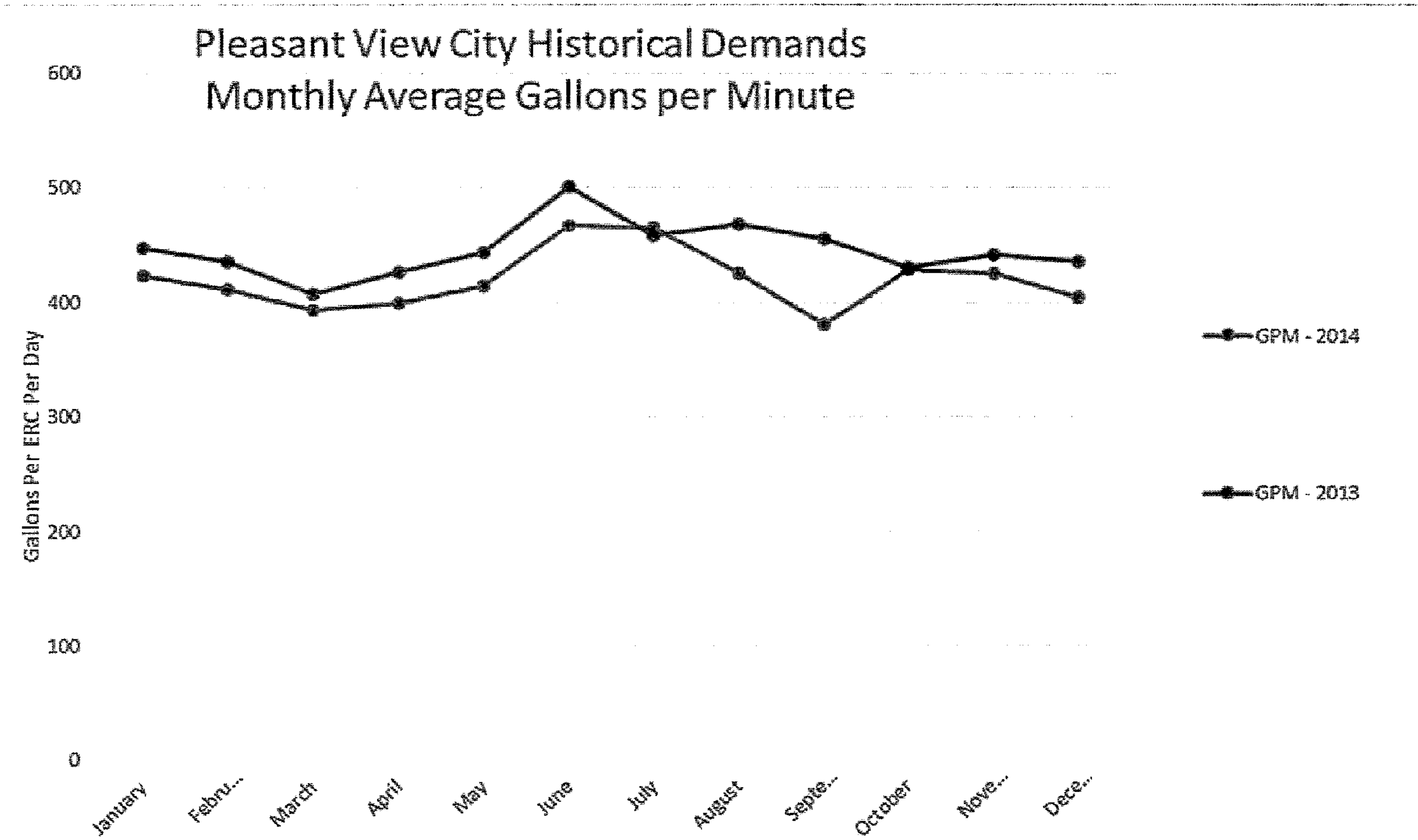
- Existing System

Minimum Source Requirement	Peak. Demand (GPM)
Existing (DDW)	1,222

- Existing System with Approved Lots

Minimum Source Requirement	Peak. Demand (GPM)
Existing (DDW)	1,401

Historical Demand



2013 AC-FT	2014 AC-FT
719	677

Historical Vs. DDW Minimum Requirements

Historical Source Production Approx. 30% Less than DDW Requirements

Minimum Source Requirement	Ave. Demand (GPM)	Ave. Yearly Demand (MG)	Ave. Yearly Demand (AC-FT)
Existing (DDW)	606	319	978
Exisiting (Historical)	446	234	719

Recommend pursuing DDW Reduction of Source Sizing Requirements. (Feasibility Study used a 25% Reduction for Historical Calculations)

Peak Day Demand Historical Reduction Vs. DDW

Existing System With Approved Lots

Minimum Source Requirement	Peak. Demand (GPM)
Existing (DDW)	1,401
Exisiting (Historical)	1,056

Existing Source Capacities

Water Source	Min. Flow Rate Capacity (gpm)	Yearly Volume Capacity (AC-FT)	Short Term Capacity Peak Day (gpm)
Mac Wade Well	357	576	397
Jesse Creek Well	25	40	100
Alder Creek Well	100	161	140
Well #4	60	97	300
Little Missouri Spring	30	48	30
Alder Creek Spring	120	194	120
Total	**692**	**1,116**	**1,087**

Source Capacity Analysis (2,480 ERC's)

Minimum Source Requirement	Ave. Demand (GPM)	Ave. Yearly Demand (MG)	Ave. Yearly Demand (AC-FT)
Exisiting (DDW)	696	366	1,122
Existing (Historical)	521	274	840
Existing Source Capacity	692	364	1,116
Source Capacity DDW (Surplus/Deficit)	-4	-2	-6
Source Capacity Historical (Surplus/Deficit)	171	90	276

Minimum Source Requirement	Peak. Demand (GPM)
Existing (DDW)	1,401
Existing (Historical)	1,056
Existing Source Capacity	**1,087**
Source Capacity DDW (Surplus/Deficit)	-314
Source Capacity Historical (Surplus/Deficit)	31

Source Capacity Analysis Build-Out (3,741 ERCs)

Minimum Source Requirement	Ave. Demand (GPM)	Ave. Yearly Demand (MG)	Ave. Yearly Demand (AC-FT)
Build Out (DDW)	1044	548	1,683
Build Out (Historical)	779	410	1257
Existing Source Capacity	692	364	1,116
Source Capacity DDW (Surplus/Deficit)	-352	-185	-567
Source Capacity Historical (Surplus/Deficit)	-87	-46	-141

Minimum Source Requirement	Peak. Demand (GPM)
Build Out (DDW)	2,101
Build Out (Historical)	1,582
Existing Source Capacity	**1,087**
Source Capacity DDW (Surplus/Deficit)	-1,014
Source Capacity Historical (Surplus/Deficit)	-495

Storage Capacity

Water Storage	Capacity	High Water Elevation	Zone
Jesse Creek	800,000	5,517	8
Alder Creek Reservoir 1	500,000	5,340	7
Macs Reservoir	200,000	5,286	6
Alder Creek Reservoir 2	200,000	5,288	6
Well #4 Tank	500,000	5,292	6
500 West Reservoir	250,000	4,714	3
Little Missouri Reservoir	70,000	4,714	3b
Total	**2,520,000**		

Storage Analysis

Existing Minimum Storage Requirement	Storage Volume (Gal.)
Indoor	992,000
Outdoor	14,810
Fire Suppression	330,000
Emergency Storage	151,021
Total Storage Required	**1,487,831**
Existing Storage	2,520,000
Surplus/Deficit	**1,032,169**

Build Out Minimum Storage Requirement	Storage Volume (Gal.)
Indoor	1,496,400
Outdoor	14,810
Fire Suppression	330,000
Emergency Storage	226,682
Total Storage Required	**2,067,892**
Existing Storage	2,520,000
Surplus/Deficit	**452,109**

Source Feasibility Options

- New Wells
  - Upper Zone
  - Lower Zone
- Weber Basin Through Bona Vista
- Weber Basin Direct
  - Zone 1
  - Zone 3

Upper Zone Well

SUNRISE ENGINEERING, INC.

Opinion of Probable Costs

SUNRISE ENGINEERING

Project: Pleasant View City Source Feasibility Study
Proposed New Well
Owner: Pleasant View City

Project No:
Date:
By: Cliff Linford P.E.

ITEM NO.	Item	Quantity	Unit	Unit Price	AMOUNT
	Pleasant View Proposed New Well				
1	Land	1	LS	$ 100,000.00	$ 100,000.00
2	Exploratory Drilling	3	EA	$ 150,000.00	$ 450,000.00
3	Well House	1	LS	$ 175,000	$ 175,000.00
4	Underground Utilities	3950	LF	$ 110	$ 434,500.00
5	Mobilization	1	LS	$ 35,000	$ 35,000.00
6	Well Drilling	600	LF	$ 370	$ 222,000.00
7				**Subtotal**	**$ 1,416,500.00**
8	**Professional Services**				
9	Hydrogeology Evaluation	1	LS	$ 20,000	$ 20,000.00
10	Well Drilling Design & CM	1	LS	$ 35,000	$ 35,000.00
11	Well House & Utility Design	1	LS	$ 51,560	$ 51,560.00
12	Construction Management	1	LS	$ 51,560	$ 51,560.00
13				**Subtotal**	**$ 158,120.00**
14				**Total Capital Cost**	**$ 1,574,620.00**
15	**Pleasant View O&M (Per Year)**				
16	Power Costs	1	LS	$ 12,000	$ 12,000
17	System O&M	1	LS	$ 5,000	$ 5,000
18				**Subtotal**	**$ 17,000**

Lower Elevation Well

SUNRISE ENGINEERING, INC.

Opinion of Probable Costs

SUNRISE ENGINEERING

Project: Pleasant View City Source Feasibility Study
Proposed New Well (Lower Zone)
Owner: Pleasant View City

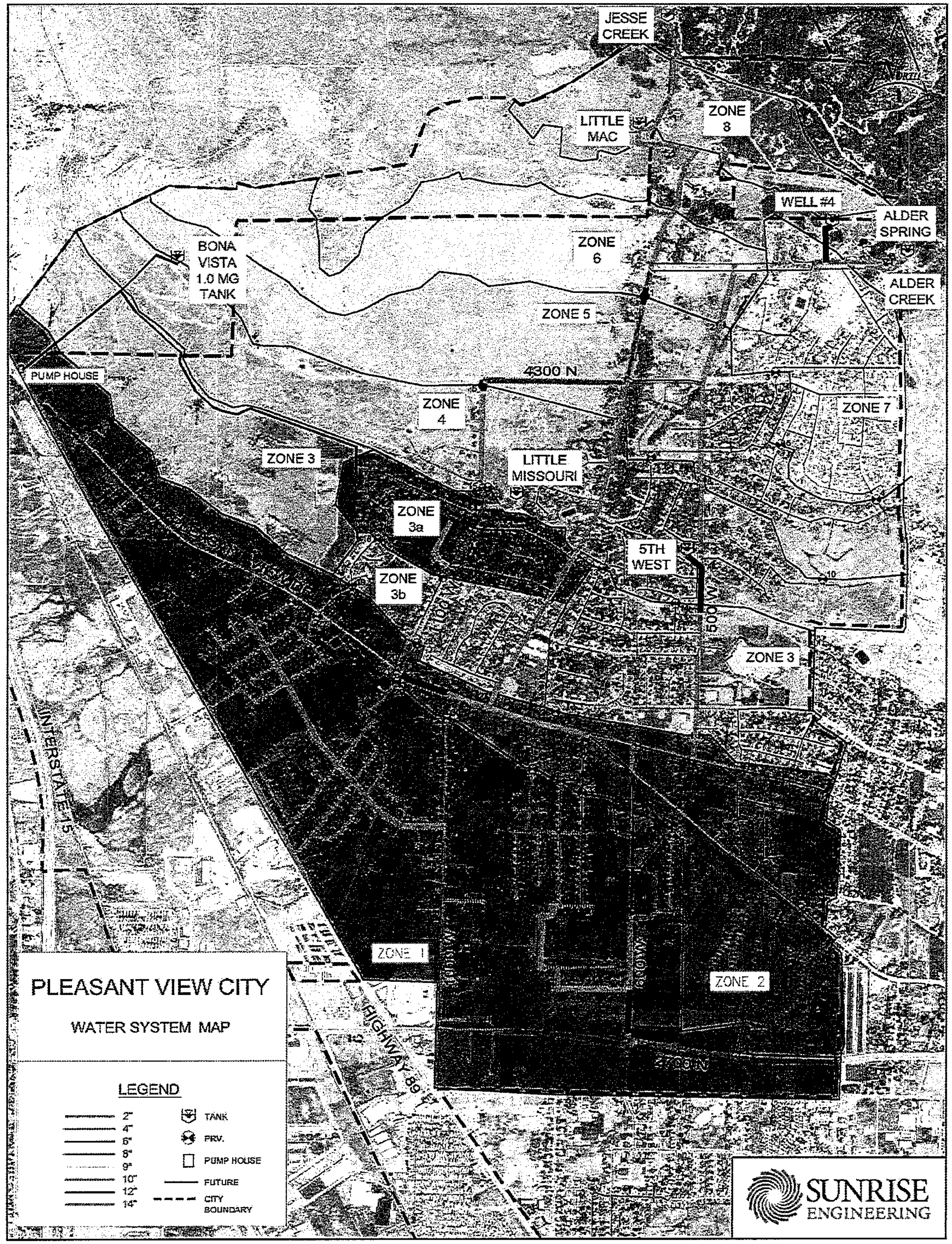
Project No:
Date:
By: Cliff Linford P.E.

ITEM NO.	Item	Quantity	Unit	Unit Price	AMOUNT
	Pleasant View Proposed New Well				
1	Land	1	LS	$ 100,000.00	$ 100,000.00
2	Exploratory Drilling	3	EA	$ 150,000.00	$ 450,000.00
3	Well House	1	LS	$ 200,000	$ 200,000.00
4	Underground Utilities	7920	LF	$ 110	$ 871,200.00
5	Mobilization	1	LS	$ 35,000	$ 35,000.00
6	Well Drilling	600	LF	$ 370	$ 222,000.00
7				**Subtotal**	**$ 1,878,200.00**
8	**Professional Services**				
9	Hydrogeology Evaluation	1	LS	$ 20,000	$ 20,000.00
10	Well Drilling Design & CM	1	LS	$ 35,000	$ 35,000.00
11	Well House & Utility Design	1	LS	$ 88,496	$ 88,496.00
12	Construction Management	1	LS	$ 88,496	$ 88,496.00
13				**Subtotal**	**$ 231,992.00**
14				**Total Capital Cost**	**$ 2,110,192.00**
15	**Pleasant View O&M (Per Year)**				
16	Power Costs	1	LS	$ 15,000	$ 15,000
17	System O&M	1	LS	$ 5,000	$ 5,000
18				**Subtotal**	**$ 20,000**

Weber Basin Through Bona Vista

Tier 2 -$351.78 per AC-FT

Tier 3 - $531.00 per AC-FT



SUNRISE ENGINEERING, INC.

Opinion of Probable Costs

Project: Pleasant View City Source Feasibility Study
Weber Basin through Bona Vista
Owner: Pleasant View City

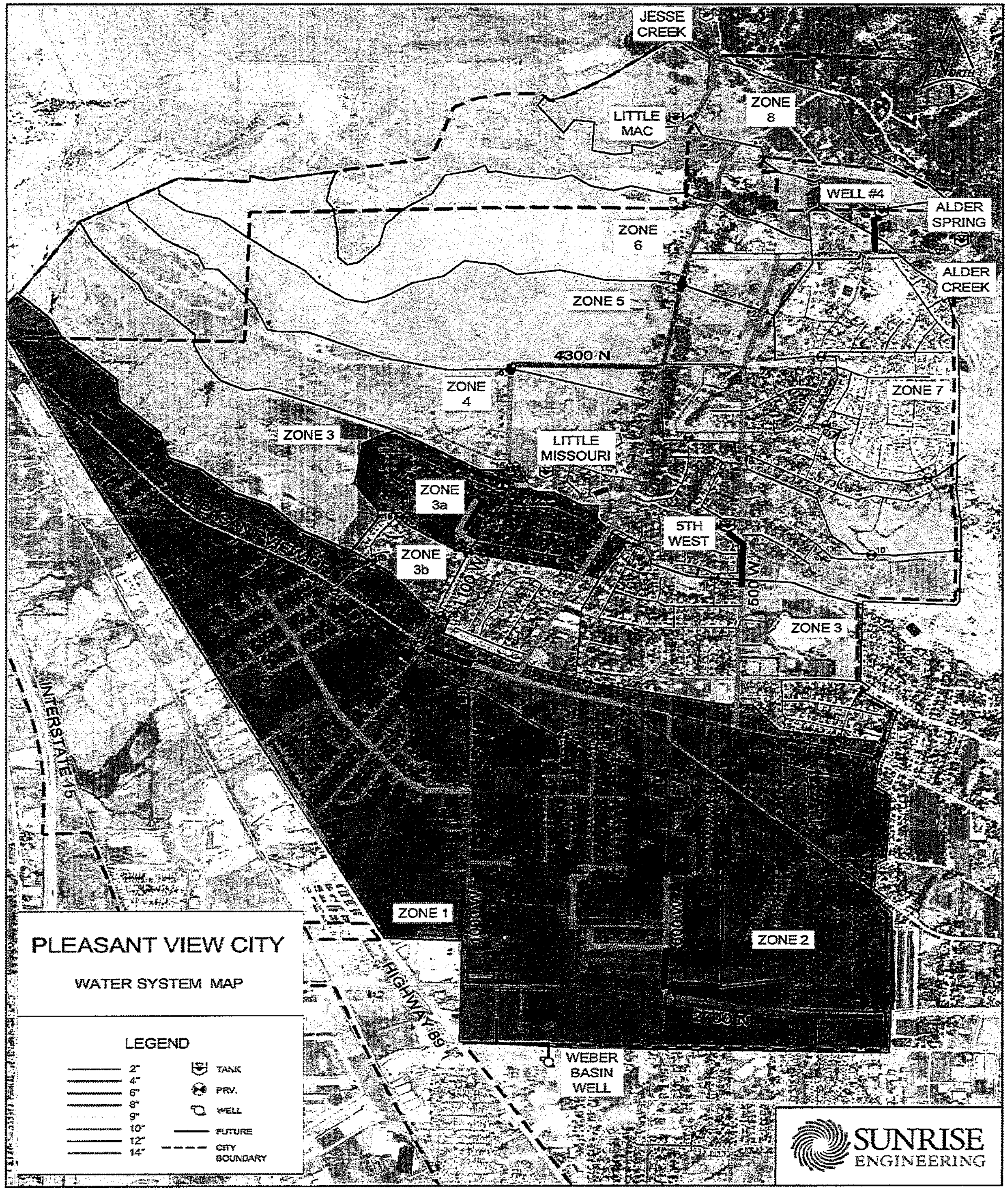
Project No:
Date:
By: Cliff Linford P.E.

ITEM NO.	Item	Quantity	Unit	Unit Price	AMOUNT
	Weber Basin Whole Sale Water Costs (Per Year)				
1	District 2 Water	300	AC-FT	$ 351.78	$ 105,534.00
2					
3	**Bona Vista Capital Purchase**				
4	1.0 MG Tank	1	LS	$ 450,000	$ 450,000.00
5	Pump House	1	LS	$ 348,998	$ 348,998.00
6	16" Transmission Line	3231	LF	$ 59.50	$ 192,244.50
7	12" Drain Line	2862	LF	$ 55.50	$ 158,841.00
8	Property (Pump House/Tank)	3.1	AC	$ 15,000	$ 46,200.00
9	Transmission Line Easement	1.48	AC	$ 7,500	$ 11,100.00
10				**Subtotal**	**$ 1,207,383.50**
11	Depreciation	**1**	**LS**	**$ (291,537)**	**$ (291,537)**
12			**Total Bona Vista Capital Cost**		**$ 915,847**
13	**Bona Vista Wheeling Agreements (Per Year)**				
14	Storage	1	LS	$ 9,187	$ 9,187
15	Distribution Capacity	1	LS	$ 4,200	$ 4,200
16	System O&M	1	LS	$ 5,000	$ 5,000
17				**Subtotal**	**$ 18,387**
18	**Pleasant View Transmission Line**				
19	12" Transmission Line	5500	LF	$ 75	$ 412,500
20	Connections	2	EA	$ 5,000	$ 10,000
21	Meter Vault	1	EA	$ 50,000	$ 50,000
22		**Subtotal Pleasant View Capital Cost**			**$ 495,887.00**
23	**Professional Services**				
24	Engineering Design	10%			$ 49,589
25	Construction Management	10%			$ 49,589
26				**Sub Total**	**$ 99,177**
27				**Project Total**	**$ 595,064**
23	**Pleasant View O&M (Per Year)**				
28	Power Costs	1	LS	$ 12,000	$ 12,000
29	System O&M	1	LS	$ 5,000	$ 5,000
30				**Subtotal**	**$ 17,000**

Weber Basin Direct Zone 1

Tier 2 -$351.78 per AC-FT

Tier 3 - $531.00 per AC-FT



SUNRISE ENGINEERING, INC.

SUNRISE ENGINEERING

Opinion of Probable Costs

Project: Pleasant View City Source Feasibility Study
Weber Basin through North Weber Well
Owner: Pleasant View City

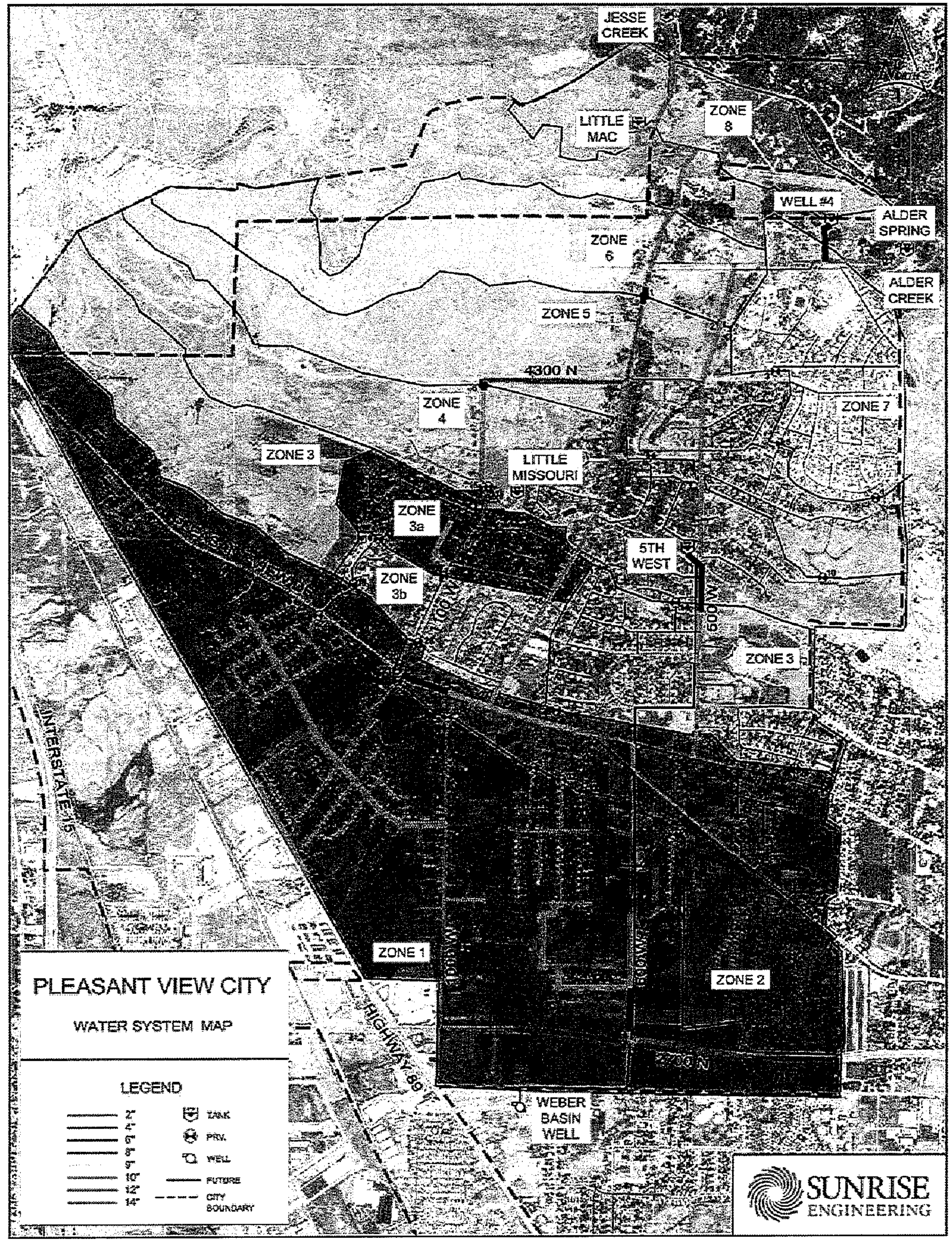
Project No:
Date:
By: Cliff Linford P.E.

ITEM NO.	Item	Quantity	Unit	Unit Price	AMOUNT
	Weber Basin Whole Sale Water Costs (Per Year)				
1	District 2 Water	300	AC-FT	$ 351.78	$ 105,534.00
2					
3	**Pleasant View System Upgrades**				
4	Pump Station	1	LS	$ 300,000	$ 300,000
5	Transmission Line	2,000	LF	$ 110	$ 220,000
6	Meter Vault	1	EA	$ 50,000	$ 50,000
7				**Subtotal Construction Cost**	**$ 570,000.00**
8	**Professional Services**				
9	Engineering Design	10%			$ 57,000
10	Construction Management	10%			$ 57,000
11				**Sub Total**	**$ 114,000**
12				**Project Total**	**$ 684,000**
13	**Pleasant View O&M (Per Year)**				
14	Power Costs	1	LS	$ 5,000	$ 5,000
15	System O&M	1	LS	$ 5,000	$ 5,000
16				**Subtotal**	**$ 10,000**

Weber Basin Direct Zone 3

Tier 2 -$351.78 per AC-FT

Tier 3 - $531.00 per AC-FT



SUNRISE ENGINEERING, INC.

SUNRISE ENGINEERING

Opinion of Probable Costs

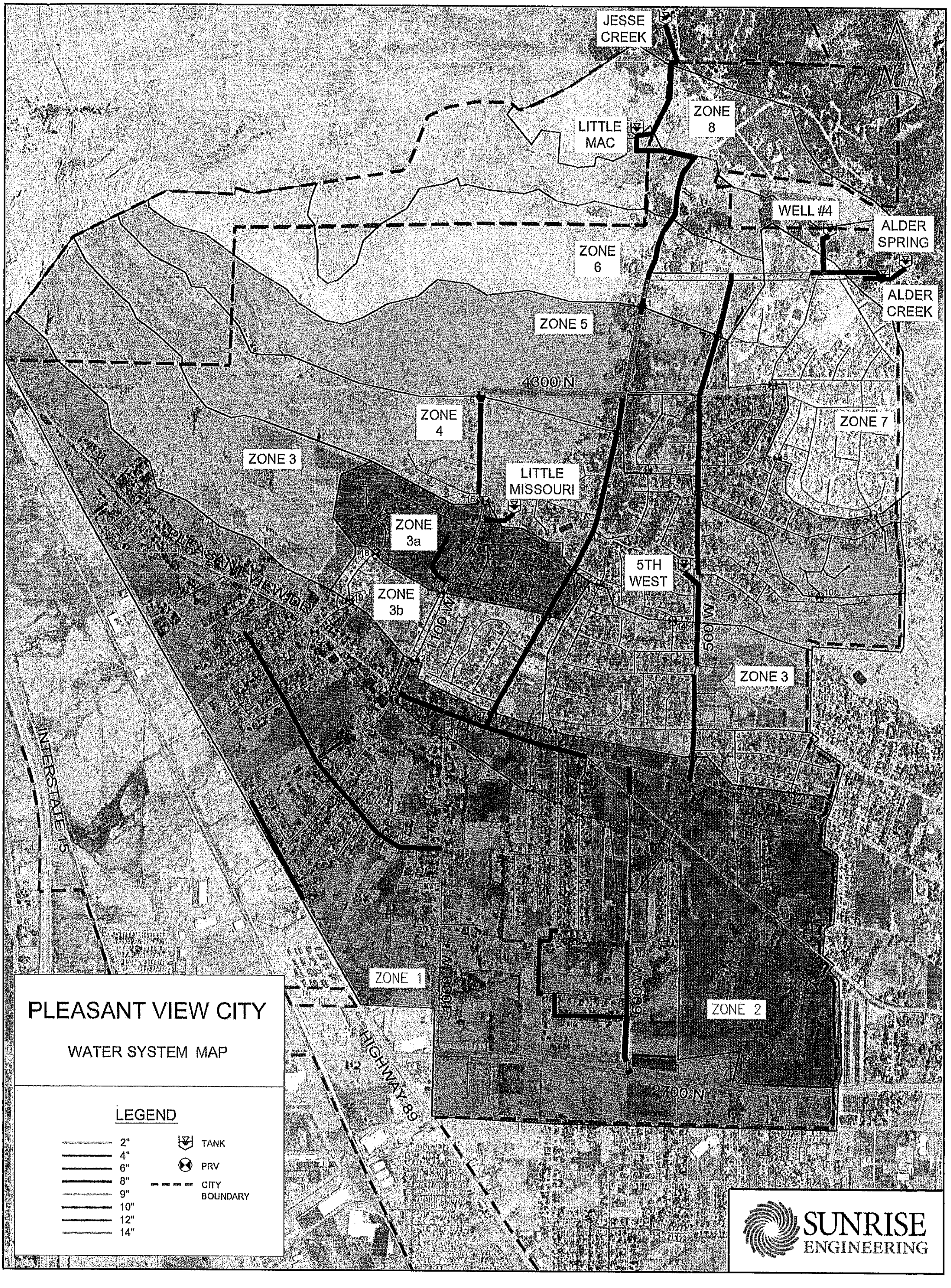
Project: Pleasant View City Source Feasibility Study
Weber Basin through North Weber Well
Owner: Pleasant View City

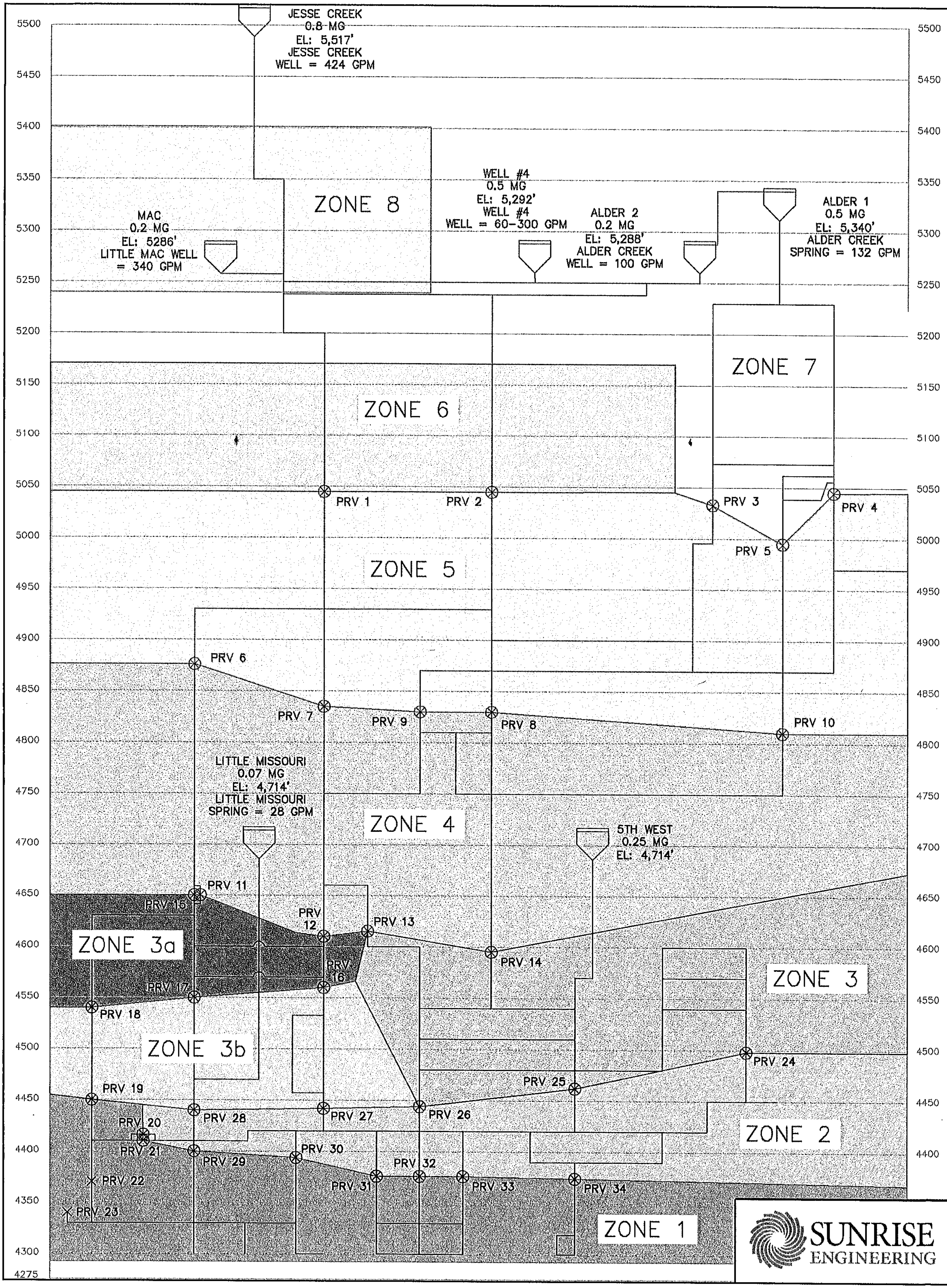
Project No:
Date:
By: Cliff Linford P.E.

ITEM NO.	Item	Quantity	Unit	Unit Price	AMOUNT
	Weber Basin Whole Sale Water Costs (Per Year)				
1	District 2 Water	300	AC-FT	$ 351.78	$ 105,534.00
2					
3	**Pleasant View System Upgrades**				
4	Pump Station	1	LS	$ 400,000	$ 400,000
5	Transmission Line	11,600	LF	$ 110	$ 1,276,000
6	Meter Vault	1	EA	$ 50,000	$ 50,000
7				**Sub Total**	**$ 1,726,000.00**
8	**Professional Services**				
9	Engineering Design	10%			$ 172,600
10	Construction Management	10%			$ 172,600
11				**Sub Total**	**$ 345,200**
12				**Project Total**	**$ 2,071,200**
13	**Pleasant View O&M (Per Year)**				
14	Power Costs	1	LS	$ 12,000	$ 12,000
15	System O&M	1	LS	$ 5,000	$ 5,000
16				**Subtotal**	**$ 17,000**

Source Feasibility Options Comparisons

Source Options	Capital Cost	Annual Costs	$/Ac-Ft	$/Kgal
Pleasant View Well (Upper)	$ 1,574,620.00	$ 17,000.00	$ 409.46	$ 1.26
Weber Basin Direct Zone 1	$ 684,000.00	$ 115,534.00	$ 538.37	$ 1.65
Pleasant View Well (Lower)	$ 2,110,192.00	$ 20,000.00	$ 539.46	$ 1.66
Weber Basin Bona Vista	$ 1,510,911.40	$ 140,921.00	$ 808.26	$ 2.48
Weber Basin Direct Zone 3	$ 2,071,200.00	$ 122,534.00	$ 872.50	$ 2.68
Residential Retail			$ 729.37	$ 2.24


PLEASANT VIEW CITY
WATER SYSTEM MAP
LEGEND
2"
4"
6"
8"
9"
10"
12"
14"
TANK
PRV
CITY BOUNDARY
SUNRISE ENGINEERING
JESSE CREEK
NORTH
ZONE 8
LITTLE MAC
WELL #4
ALDER SPRING
ALDER CREEK
ZONE 6
ZONE 5
4300 N
ZONE 4
ZONE 7
ZONE 3
LITTLE MISSOURI
ZONE 3a
5TH WEST
ZONE 3b
1100 W
500 W
PLEASANT VIEW DR
ZONE 3
INTERSTATE 15
ZONE 1
1000 W
600 W
ZONE 2
HIGHWAY 89
2700 N



JESSE CREEK
0.8 MG
EL: 5,517'
JESSE CREEK
WELL = 424 GPM
ZONE 8
MAC
0.2 MG
EL: 5286'
LITTLE MAC WELL
= 340 GPM
WELL #4
0.5 MG
EL: 5,292'
WELL #4
WELL = 60-300 GPM
ALDER 2
0.2 MG
EL: 5,288'
ALDER CREEK
WELL = 100 GPM
ALDER 1
0.5 MG
EL: 5,340'
ALDER CREEK
SPRING = 132 GPM
ZONE 7
ZONE 6
PRV 1
PRV 2
PRV 3
PRV 4
PRV 5
ZONE 5
PRV 6
PRV 7
PRV 9
PRV 8
PRV 10
LITTLE MISSOURI
0.07 MG
EL: 4,714'
LITTLE MISSOURI
SPRING = 28 GPM
ZONE 4
5TH WEST
0.25 MG
EL: 4,714'
PRV 11
PRV 15
PRV 12
PRV 13
PRV 14
ZONE 3a
PRV 16
PRV 17
PRV 18
ZONE 3
ZONE 3b
PRV 24
PRV 25
PRV 19
PRV 28
PRV 27
PRV 26
PRV 20
PRV 21
PRV 29
PRV 30
ZONE 2
PRV 32
PRV 22
PRV 31
PRV 33
PRV 34
PRV 23
ZONE 1
SUNRISE ENGINEERING
5500
5450
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5250
5200
5150
5100
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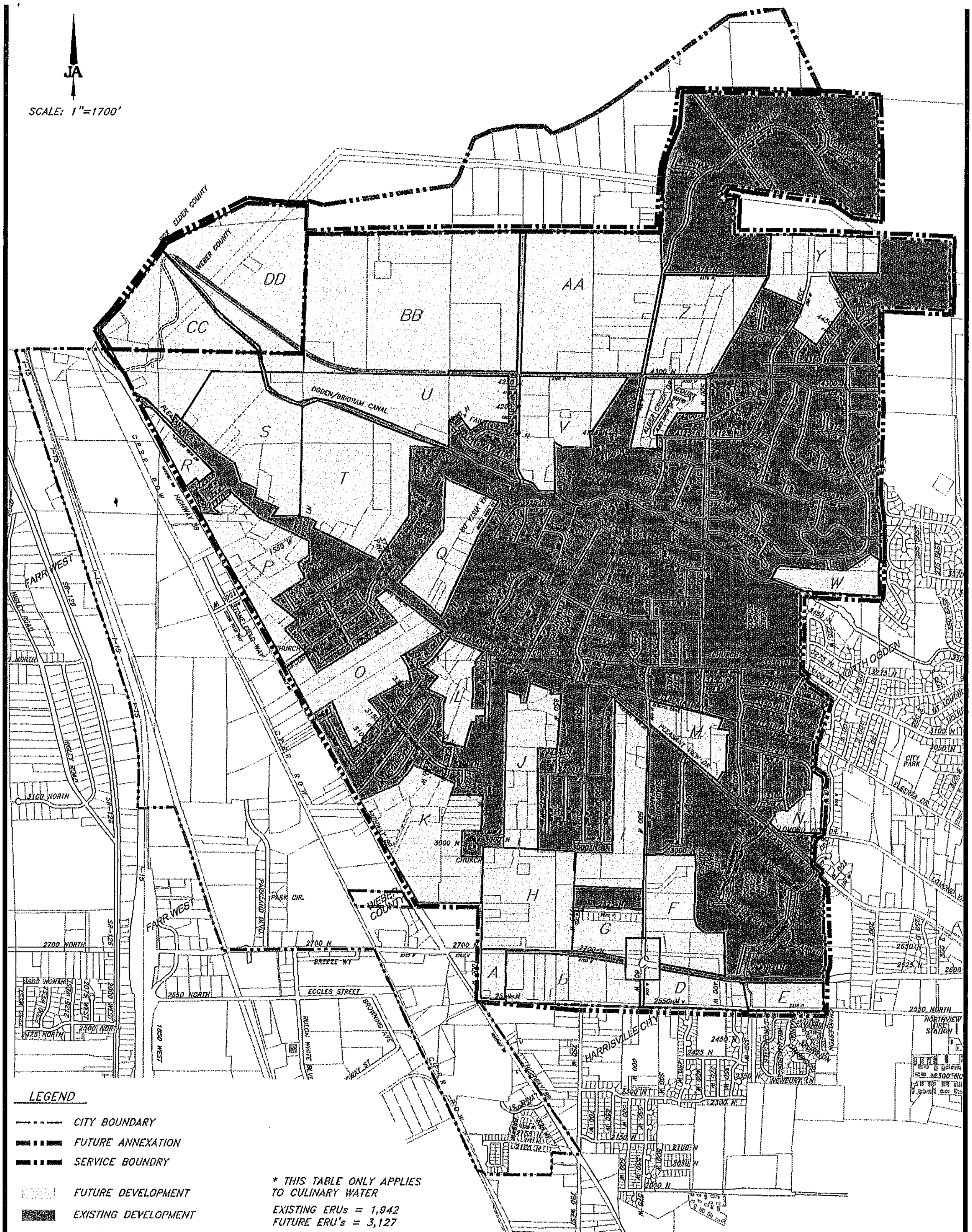

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D	65	I	97	N	16	S	208	X	33	CC	135
E	306	J	88	O	165	T	265	Y	78	DD	59

SHEET: 5 OF 1 SHEETS

SCALE: 24"x36" 1" = 850' / 11"x17" 1" = 1700'

SLS DESIGNED / DDA DRAWN / KLJ CHECKED

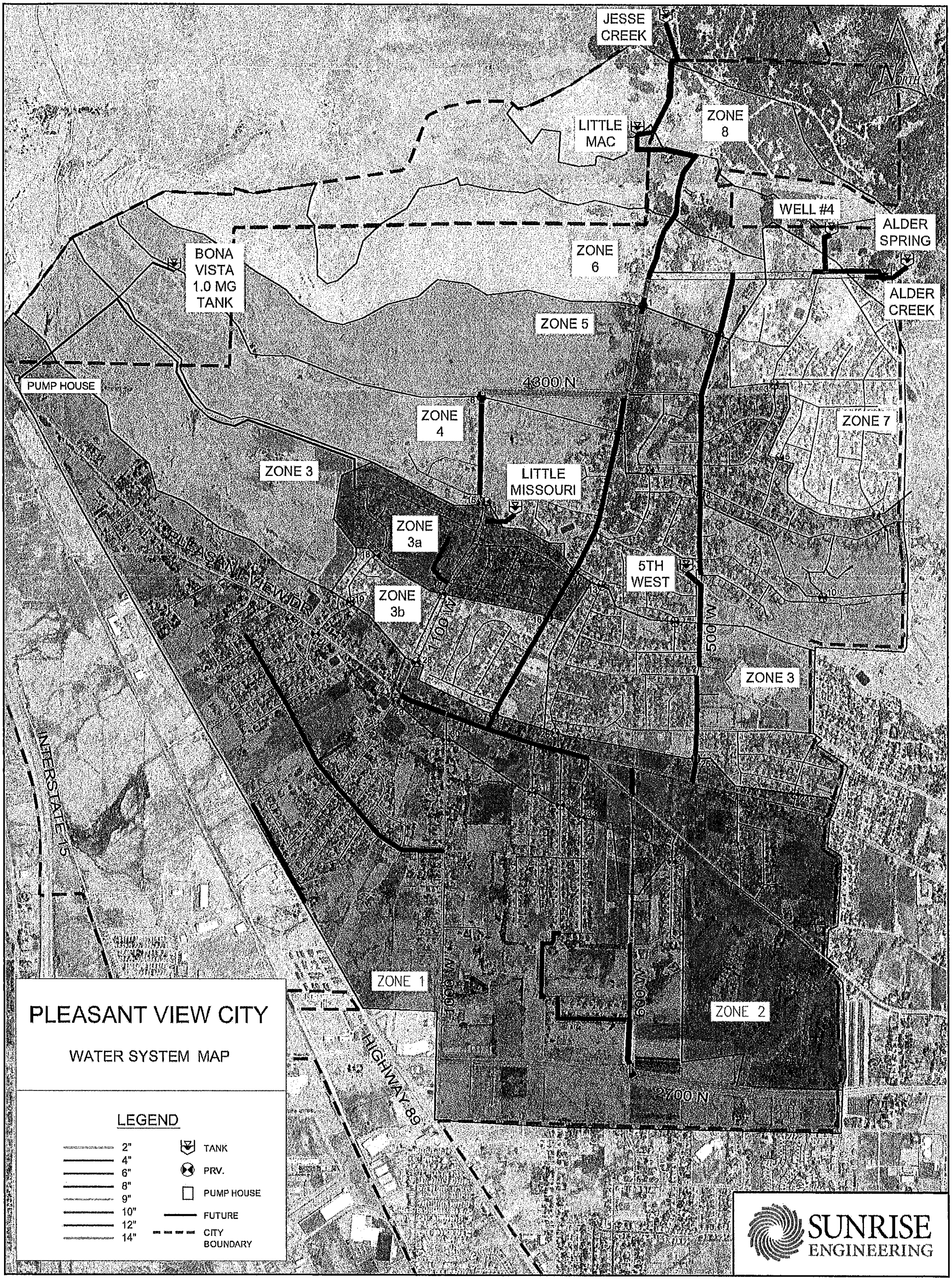
DATE	DESCRIPTION

PLEASANT VIEW CITY CORPORATION

CULINARY WATER MASTER PLAN & IMPACT FEE STUDY

FIGURE 1 – SERVICE AREA & LAND USE MAP

JA JONES & ASSOCIATES CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403


JESSE CREEK
LITTLE MAC
ZONE 8
NORTH
WELL #4
ALDER SPRING
ALDER CREEK
BONA VISTA 1.0 MG TANK
ZONE 6
ZONE 5
PUMP HOUSE
4300 N
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1100 W
500 W
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2700 N
PLEASANT VIEW CITY
WATER SYSTEM MAP
LEGEND
2"
4"
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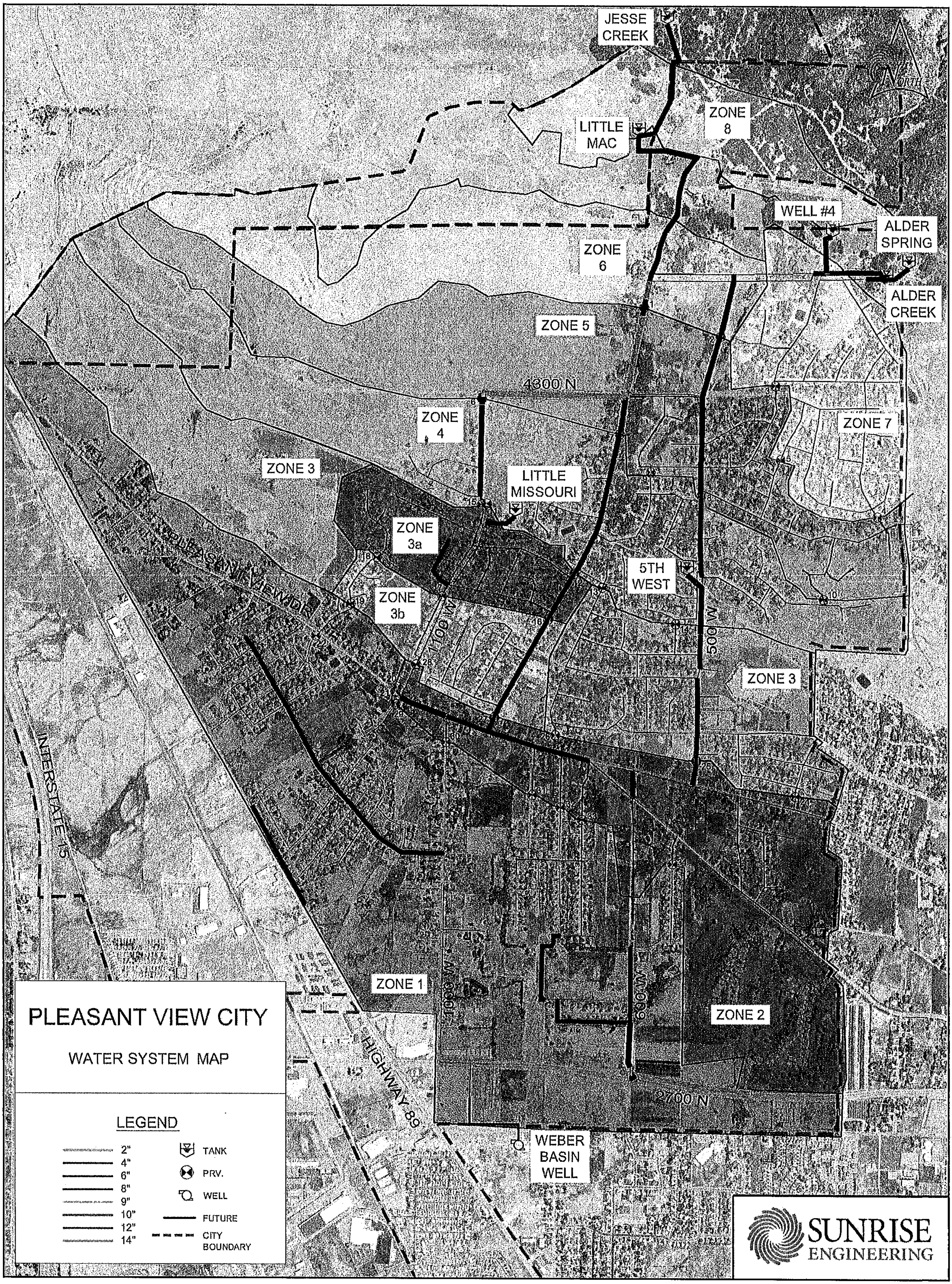
PRV.
PUMP HOUSE
FUTURE
CITY BOUNDARY
SUNRISE ENGINEERING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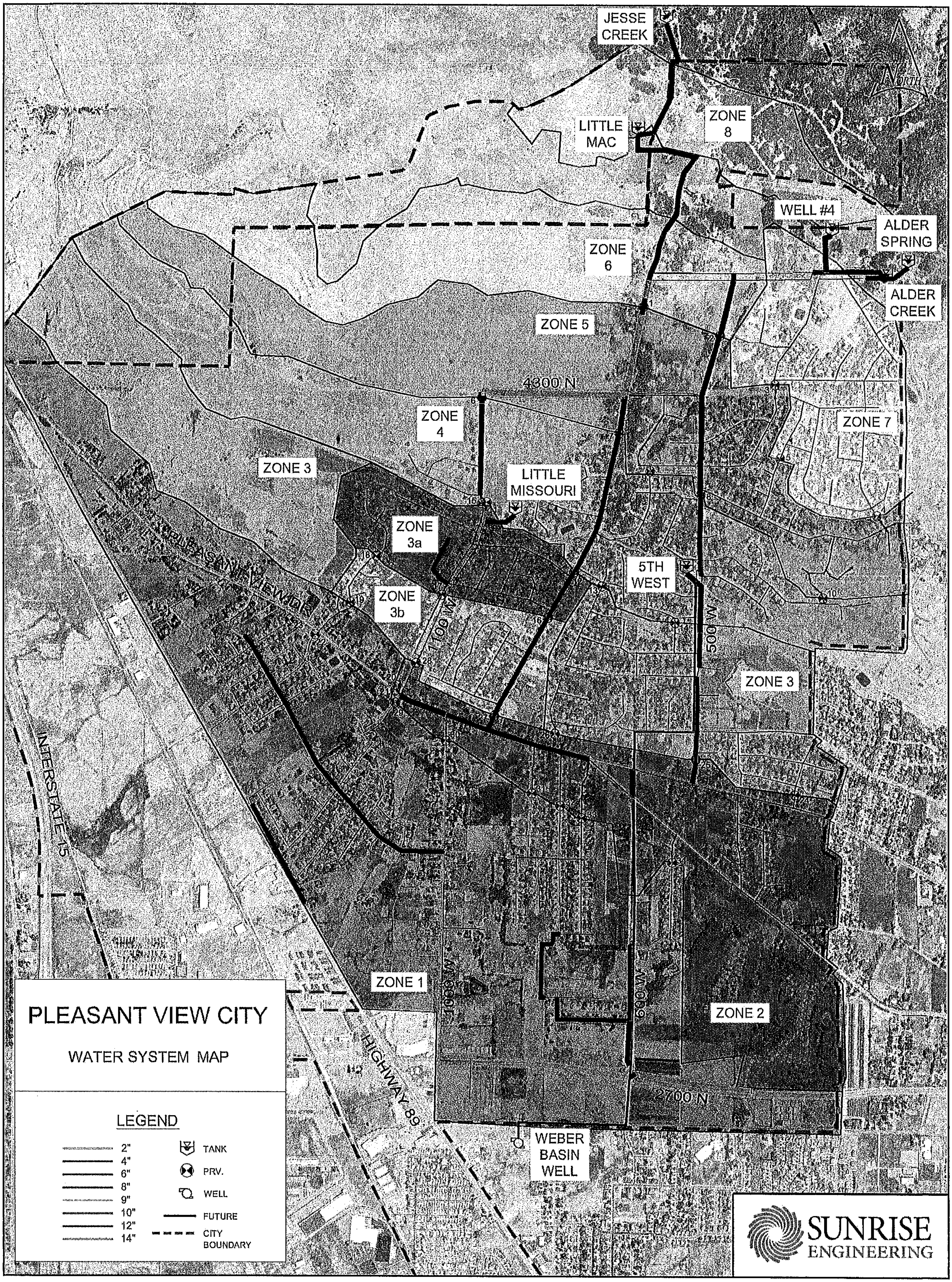
HIGHWAY 89
2700 N
WEBER BASIN WELL



JESSE CREEK
LITTLE MAC
ZONE 8
NORTH
WELL #4
ALDER SPRING
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ALDER CREEK
ZONE 5
4300 N
ZONE 4
ZONE 7
ZONE 3
LITTLE MISSOURI
ZONE 3a
5TH WEST
PLEASANT VIEW DR
ZONE 3b
1100 W
500 W
ZONE 3
INTERSTATE 15
ZONE 1
1000 W
900 W
ZONE 2
HIGHWAY 89
2700 N
WEBER BASIN WELL
PLEASANT VIEW CITY
WATER SYSTEM MAP
LEGEND
2"
4"
6"
8"
9"
10"
12"
14"
TANK
PRV.
WELL
FUTURE
CITY BOUNDARY
SUNRISE ENGINEERING

SUNRISE
ENGINEERING

PLEASANT VIEW CITY
SOURCE AND STORAGE FEASIBILITY STUDY

DRAFT

DRAFT

PLEASANT VIEW SOURCE AND STORAGE FEASIBILITY STUDY
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1 INTRODUCTION

Sunrise Engineering was hired by Pleasant View City to prepare a feasibility study on source and storage for the Culinary Water System. The purpose of the study is analyze its current source capacity, current storage capacity, and perform a feasibility study on different options to acquire additional source. Specifically the City desires to address the feasibility of drilling new wells versus purchasing water through a Whole-Sale provider. The objectives of this study are as follows:

1. Provide a basic understanding of the key elements of the system including existing sources, storage facilities, pipe networks, pressure zones, and demand areas.
2. Show the water needs of Pleasant View City focusing on existing and future demand needs.
3. Provide an understanding of the existing water sources; discuss their existing capacity, their ability to meet the future demands of the water system.
4. Provide an understanding of the existing water storage facilities, evaluate their condition and capacities, and evaluate existing and future storage needs for fire suppression.
5. Provide an understanding of the distribution system in order to evaluate the feasibility of different source and storage options.
6. Provide overall recommendations for the water system including source and storage recommendations.
7. Provide a feasibility assessment of different source options; including drilling new wells, purchasing water from Weber Basin direct, and purchasing wholesale water through Weber Basin with it being wheeled through Bona Vista Water Improvement District.

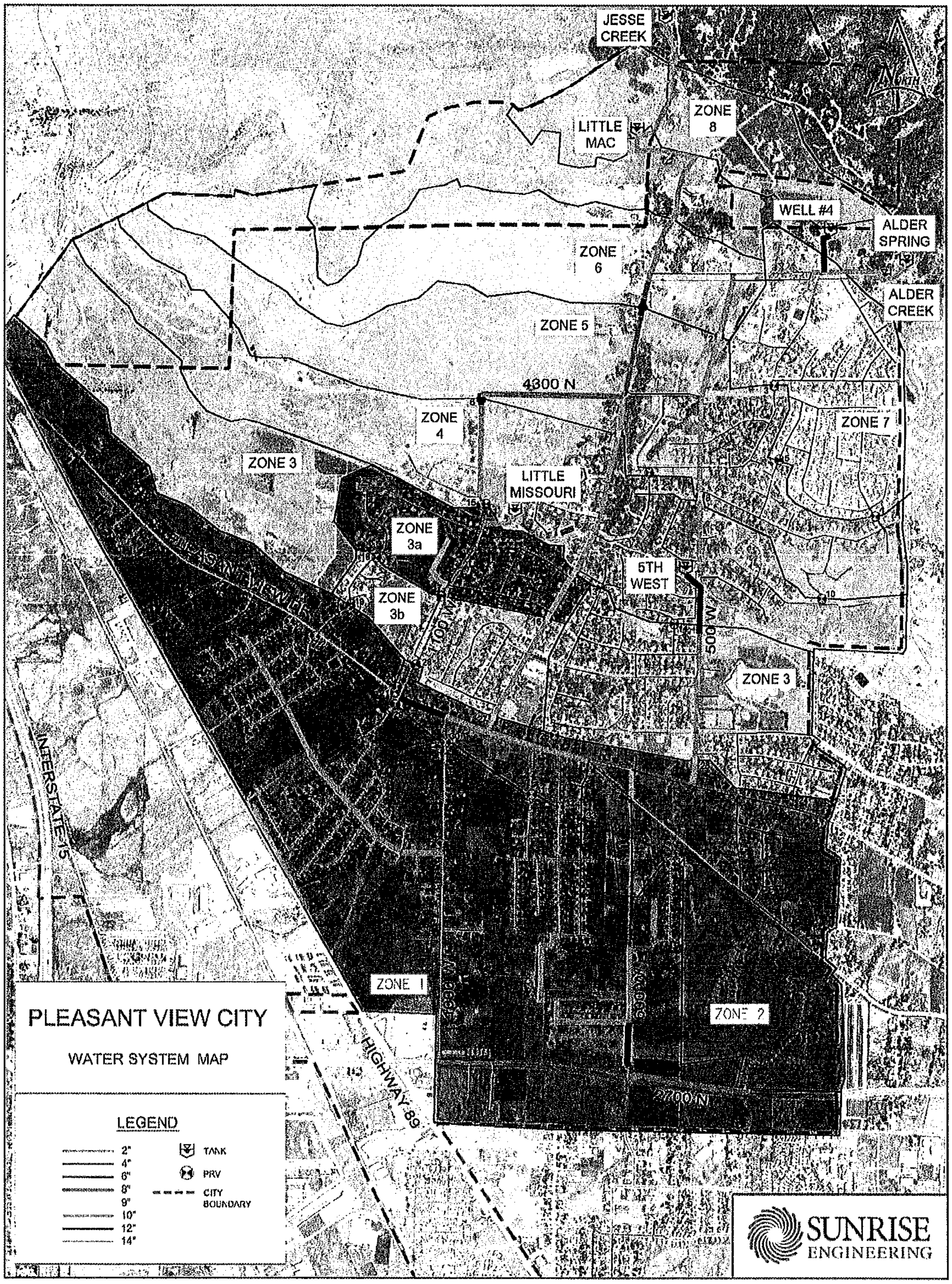
The items to be discussed in this feasibility study will focus on the existing system in 2015, followed by a build out scenario using the current planning and zoning maps.

2 PLEASANT VIEW CULINARY WATER SYSTEM OVERVIEW

2.1 System Pressure Zones and System Overview

The Pleasant View culinary water system is located in Weber County, within the city of Pleasant View, Utah. The system functions as a gravity fed system with its wells and the majority of its storage at higher elevations within the system. The lower zones are being fed from the upper zones through pressure reducing valve stations (PRVs). The system is composed of eight main pressure zones that are delineated by boundary valves and pressure reducing valves as required. Pressure zones in water systems are established in order to keep the water pressure between 40 psi and 125 psi. This helps avoid low pressures to residents and also extreme high pressures that can damage the system. The pressure zones in the Pleasant View system are referred to as Zones 1 through 8. Zone 8 is the highest zone in elevation with Zone 1 being the lowest zone in elevation. Pressure Zone 3 is divided into three different zones Zone 3a, 3b, and 3. Zone 3a and Zone 3 are fed through PRVs, while zone 3b is fed from the Little Missouri Tank and its spring. These zones are physically separated, but are all within the elevation of Zone 3. Figure 2.0 illustrates the piping and pressure zones of the Pleasant View Culinary Water System.

Figure 2.0- Pleasant View City Water System and Pressure Zones



2.2 Water System Facilities and Assets

Every water system is composed of facilities and assets. A basic understanding of the Pleasant View facilities and assets provides a better understanding of the system as a whole, and what goes into a water system. Water systems are composed of the following basic facilities and assets:

- Water Sources
- Water Storage Facilities
- Water Pipelines
- PRV Stations & Control Vaults

Table 2.1 below shows the specific facilities and assets in the Pleasant View culinary water distribution system including the pressure zone that they serve. Figure 2.0 shows a map of the major facilities and assets in the Pleasant View water system.

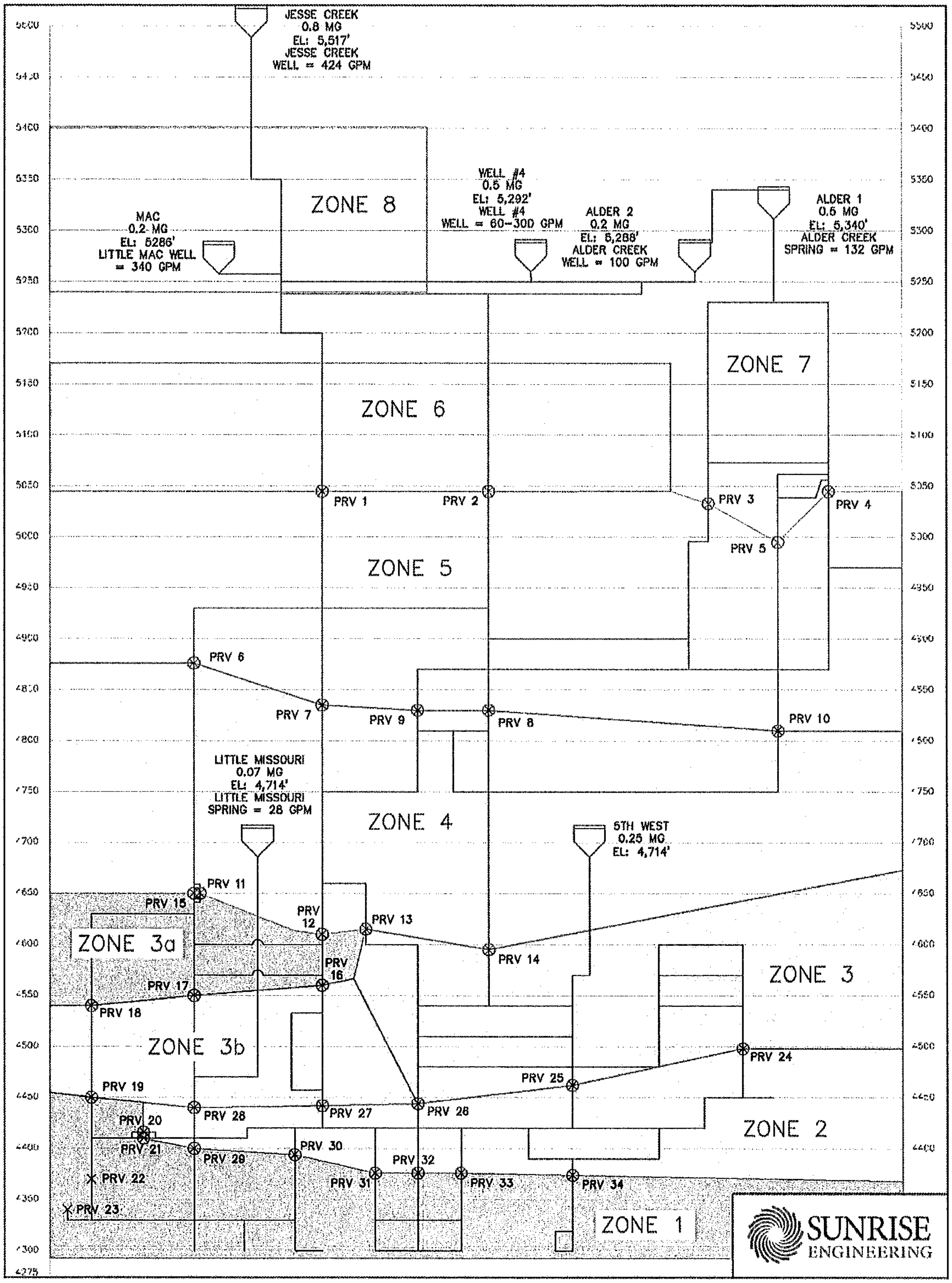
Table 2.0- Overview of Pleasant View Water Facilities

Model Component	Name	Elevation Ft	Pressure Setting PSI	Height (FT)	Flow (GPM)	Hydraulic Grade Line (FT)				Zone
T6	Jesse Creek	5,501	NA	16	NA	5,517		-	800,000	8
T26	Alder Creek Reservoir 1	5,324	NA	16	NA	5,340		-	500,000	7
T5	Macs Reservoir	5,286	NA	16	NA	5,286			200,000	6
T21	Alder Creek Reservoir 2	5,276	NA	12	NA	5,288		-	200,000	6
	Well #4 Tank	5,276	NA	16	NA	5,292		-	500,000	6
T16	500 West Reservoir	4,698	NA	16	NA	4,714		-	250,000	3
T1	Little Missouri Reservoir	4,702	NA	12	NA	4,714		-	70,000	3b
									2,520,000	
	Jesse Creek Well	5,500			100					8
	Alder Creek Well	5,340			138.5					7
	Well #4	5,280			300					6
	Mac Wade Well	5,286			357					6
	Alder Creek Spring	5,276			115					6
	Little Missouris Spring	4,702			30					3b
					1,041					
2	0: Pressure Reducing Valve	5,045	45	NA		5,149	10.00	NA		5
1	0: Pressure Reducing Valve	5,045	45	NA		5,149	12.00	NA		5
4	0: Pressure Reducing Valve	5,045	58	NA		5,179	6.00	NA		5
3	0: Pressure Reducing Valve	5,033	51	NA		5,151	8.00	NA		5
5	0: Pressure Reducing Valve	4,995	67	NA		5,150	6.00	NA		5
6	0: Pressure Reducing Valve	4,876	36	NA		4,959	12.00	NA		4
7	0: Pressure Reducing Valve	4,835	54	NA		4,960	6.00	NA		4
9	0: Pressure Reducing Valve	4,830	56	NA		4,959	8.00	NA		4
8	0: Pressure Reducing Valve	4,830	56	NA		4,959	10.00	NA		4
10	0: Pressure Reducing Valve	4,810	65	NA		4,960	8.00	NA		4
12	0: Pressure Reducing Valve	4,610	74	NA		4,781	6.00	NA		3a
11	0: Pressure Reducing Valve	4,670	48	NA		4,781	8.00	NA		3a
15	0: Pressure Reducing Valve	4,670	48	NA		4,781	8.00	NA		3a
13	0: Pressure Reducing Valve	4,615	40	NA		4,707	6.00	NA		3
14	0: Pressure Reducing Valve	4,595	49	NA		4,708	4.00	NA		3
16	0: Pressure Reducing Valve	4,560	64	NA		4,708	6.00	NA		3b
17	0: Pressure Reducing Valve	4,550	68	NA		4,707	6.00	NA		3b
18	0: Pressure Reducing Valve	4,540	73	NA		4,709	6.00	NA		3b
24	0: Pressure Reducing Valve	4,498	66	NA		4,650	6.00	NA		2
25	0: Pressure Reducing Valve	4,462	81	NA		4,649	10.00	NA		2
26	0: Pressure Reducing Valve	4,444	89	NA		4,650	8.00	NA		2
27	0: Pressure Reducing Valve	4,442	90	NA		4,650	6.00	NA		2
28	0: Pressure Reducing Valve	4,440	91	NA		4,650	6.00	NA		2
20	0: Pressure Reducing Valve	4,410	67	NA		4,565	8.00	NA		1
21	0: Pressure Reducing Valve	4,410	67	NA		4,565	8.00	NA		1
29	0: Pressure Reducing Valve	4,400	63	NA		4,546	8.00	NA		1
30	0: Pressure Reducing Valve	4,394	65	NA		4,544	8.00	NA		1
33	0: Pressure Reducing Valve	4,376	73	NA		4,545	6.00	NA		1
32	0: Pressure Reducing Valve	4,376	73	NA		4,545	8.00	NA		1
31	0: Pressure Reducing Valve	4,376	73	NA		4,545	8.00	NA		1
34	0: Pressure Reducing Valve	4,374	74	NA		4,545	8.00	NA		1
22	0: Pressure Reducing Valve	4,370	84	NA		4,564	8.00	NA		?
23	0: Pressure Reducing Valve	4,340	97	NA		4,564	8.00	NA		?
19	0: Pressure Reducing Valve	4,450	50	NA		4,566	6.00	NA		1

2.3 Pleasant View Culinary Water System Hydraulic Profile Schematic

Figure 2.3 is a hydraulic profile schematic map of Pleasant View's culinary water system that summarizes all of the key elements in the system and how they interact to provide water for the pressure zones within the system. The key elements include pressures zones, major transmission lines, storage facilities, and sources.

Figure 2.3- Pleasant View City Hydraulic Profile



3 CONNECTIONS AND GROWTH

For any water system feasiblity study it is important to determine how many connections exist on the water system, where in the system they are located, and how much water each connection typically uses during normal time periods and also during peak usage months. This connection information is essential to analyzing the existing condition of the water system and projecting and locating capital improvement projects to keep the system running smoothly and in compliance with state rules and regulations for drinking water systems.

This section of the feasibility study provides a detailed discussion of existing connections on the water system and how this number was determined for this feasiblity study. This section also shows the number of connections for each pressure zone in the system. The final part of this section is an analysis of build out with the current zoning and the effect on future water connections in the system. The connections shown in this section will be used to determine equivalent residential connections (ERC's) and water demand in Section 4.

3.1 Existing System Connections

Pleasant View currently has 2,132 water accounts in their billing data for their water system with approvals for 322 additional lots within its culinary water system. The culinary water system serves a population of 8,571 (Governor's office of Planning and Budgeting 2013).

Almost the entire service area is supplied by secondary water for irrigation. There is one subdivision, Pole Patch, with 26 connections, that currently uses culinary water for irrigation. Pole Patch subdivision has its own water system and storage but receives all its source from Pleasant View. An additional small subdivision, Diamond Estates Subdivision has three connections that Pleasant View's culinary water system serves culinary water for irrigation. The total number of existing culinary water connections in the system including the Pole Patch subdivision is 2,158 connections. For the existing system capacity analysis the 322 additional approved lots will be included for a total of 2,480 connections.

The number of existing connections in the Pleasant View water system is shown in Table 3.0 below, listed by pressure zone.

Table 3.0- Existing Pleasant View Water System Connections (Population 8,571)

Zone	Existing Connections
8	26
7	9
6	210
5	179
4	252
3	252
3a	145
3b	114
2	306
1	665
Pleasant View City	**2,158**

3.2 Projected Future System Connections

As stated previously, one purpose of this feasibility study is to evaluate the Pleasant View water system for build out with the current zoning. This requires that the author of the plan make projections on future population and future connections on the water system. The projections will evaluate source and storage. This will allow the city to plan for the future, and helps them plan for infrastructure upgrades and capital improvement needs in the future.

There are various methods for projecting population and future growth for cities. For this feasibility study, an analysis of areas within Pleasant View's service area was performed to determine the build out connections per the current zoning. Basically, a map was overlayed showing the current zoning within areas of the City that remain to be built out. These areas were divided by zone, then the ERC's per acre as shown in the table below was applied to the available area. Table 3.2 below shows the future water system connections within Pleasant View City's water system service area. It should be noted that actual build out conditions may change has future zoning is modified. See Appendix for figures and calculations.

Table 3.1- Connections per Acre by Zone

Zone	Lot Size (SF)	Lot Size (AC)	ERC/AC
RE20	20,000	0.46	1.74
RE15	15,000	0.34	2.32
A-2	87,120	2.00	0.45
A-5	217,800	5.00	0.18
CP-1	20,000	0.46	1.74
CP-2	20,000	0.46	1.52
CP-3	20,000	0.46	1.52

Residential 20% of area assumed for roads etc.
Agricultural 10% of area assumed for roads etc.
Commercial 30% of area assumed for roads/parking etc.

Table 3.2- Future Water System Connections for Build Out

Zone	Future Connections
8	14
7	93
6	50
5	81
4	273
3	350
3a	-
3b	-
2	56
1	666
Pleasant View City	**1,583**

Table 3.3 below shows the total estimated water system connections as build out. The total was calcutlated by adding the existing connections to the calculated future connections in the system..

Table 3.3- Water System Connections for Build Out

Zone	Existing Connections	Future Connections	Build Out Connections
8	26	14	40
7	9	93	102
6	210	50	260
5	179	81	260
4	252	273	525
3	252	350	602
3a	145	-	145
3b	114	-	114
2	306	56	362
1	665	666	1,331
Pleasant View City	**2,158**	**1,583**	**3,741**

3.3 Determination of ERC's

The State of Utah Drinking Water Rules and regulations for usage in water systems designates two categories of water connections; residential connections and other connections. The Rules require a minimum demand for indoor and outdoor usage for both types of connections. The other connections category in the state rules and regulations provides usage in the form of what is called an Equivalent Residential Connections (ERC). The ERC number of a connection is a count of how many residential connections the connection is equivalent to in terms of water usage. The majority of the connections within Pleasant View City's water system are residential connections with very few commercial connections. In reviewing the past studies, the ERC's were very similar to the actual number of connections. For this feasibility study each connection will be viewed as one ERC

4 SYSTEM DEMANDS

Each individual connection in a water system exerts a specific water demand on the system. Individual connections may require more or less water demand, depending on how much water that connection uses. As stated previously, the demand required for each connection is based off of Equivalent Residential Connections (ERC's). This section of the report uses the number of ERC's determined in the previous section to estimate water demand that will be used to evaluate the water system. The demand numbers that are calculated in this section will also be used in other sections to determine source and storage adequacy.

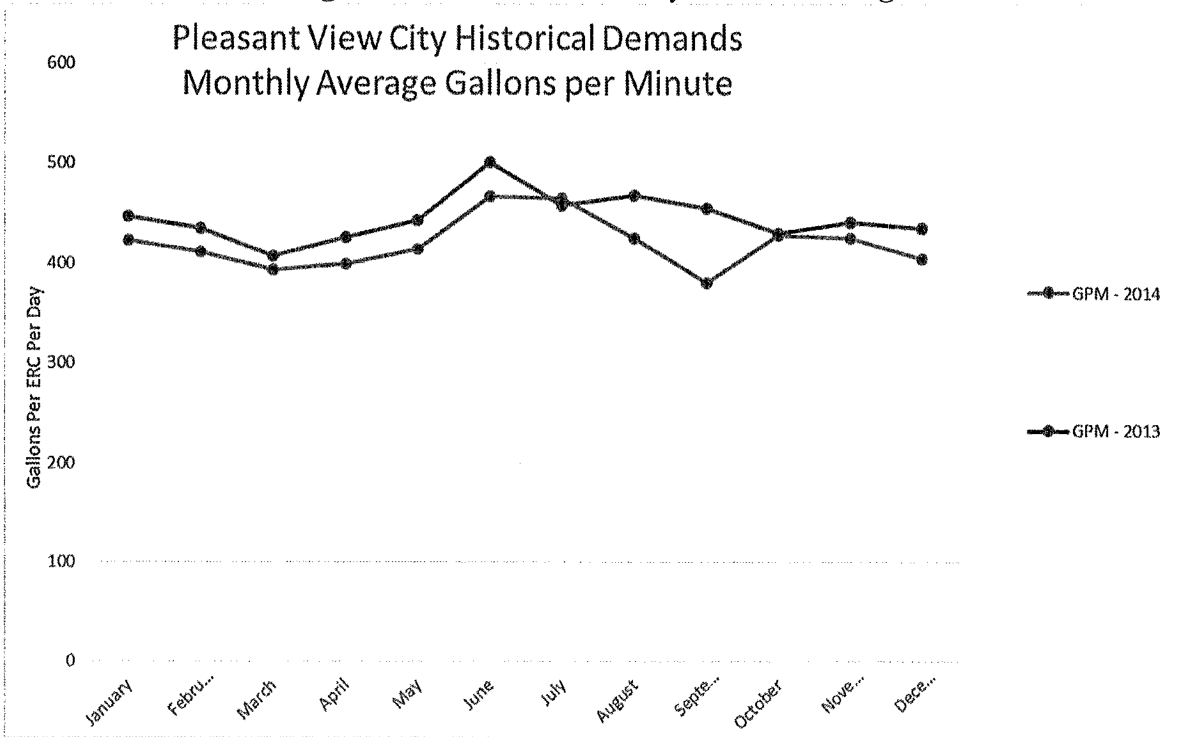
4.1 Historical Demands

Pleasant View City has begun to collect production data from their sources. They have recent existing records showing how much each of their sources produced in 2013 and 2014. This source production data is a representation of historical demands on the water system. The source production for each specific source will be discussed in detail in section 5.0. A summary of the historical source production from all of the Pleasant View's water system sources is shown in Table 4.0 below.

Table 4.0- Pleasant View Historical Monthly Source Production (Average GPM)

Month	2013 GPM	2014 GPM
January	447	423
February	435	411
March	407	393
April	426	399
May	443	414
June	501	467
July	458	465
August	468	425
September	455	380
October	430	428
November	442	425
December	435	404
Yearly Average	446	420

Figure 4.0- Pleasant View City Historical Usage



The average source production per month for the past two years has ranged from 404 GPM to 501 GPM. The maximum (peak) month from the source production data is 501 GPM, which occurred in June of 2013. The yearly AC-FT production from Pleasant View's water sources are shown in Table 4.1 below.

Table 4.1- Pleasant View Yearly Source Production (Acre-Feet)

2013 AC-FT	2014 AC-FT
719	677

4.2 Existing Demands

The State of Utah Division of Drinking Water (DDW) provides requirements for water systems regarding source sizing. Rule number R309-510-7 states the minimum source sizing requirements. Water sources shall legally (i.e. water rights) and physically meet water demands under two conditions, Peak Day Demand and Average Yearly Demand. Peak Day Demand is defined as the anticipated water demand on the day of highest water consumption. Average Yearly Demand is defined as the source capacity to provide one year's supply of water.

The State of Utah Division of Drinking Water provides a peak day demand usage for indoor water usage and average yearly demand in Table 510-1 and 510-2, shall be used as the minimum sizing requirements for peak day demand and average yearly demand for indoor water use unless a public water system has obtained a reduction per R309-510-5 based off of actual historic system usage.

This section will provide an analysis of the demands on the system based on the state DDW rules. Also provided is an explanation of how the demands were obtained. This section will also provide an analysis of historical production usage data. The section compatre the calculated DDW mimium source demands with demands from historical source production,

4.2.1 Existing Average Day Demands

For this feasibility study, the existing and proposed water system demands used are based off of existing and projected ERC's, respectively. As mentioned previously, the State of Utah Drinking Water Rules provides a minimum indoor and outdoor usage demand requirement to be used when analyzing water systems unless the system has obtained a reduction per R309-510-5. Prior to using the state minimum requirements, it should be determined whether or not the historical usage data corresponds with the DDW minimum requirements.

The State of Utah Drinking Water Rules requires a minimum demand for indoor and outdoor usage for one ERC. The State Rule for indoor demand defines average day usage of one ERC to be 146,000 gallons per year or 400 gallons per day. Multiplying the indoor demand by the number of 2,158 ERC's in the system results in an average demand of:

$$2{,}158\, ERC \times 400\frac{gal}{day\, ERC} = 863{,}200\frac{gal}{day}$$

$$863{,}200\frac{gal}{day} \times \frac{day}{24hr} \times \frac{hr}{60min} = 599\ \frac{gal}{min} \qquad \textit{Average Day Indoor Demand}$$

In addition to the existing 2,158 connections the 322 approved connections needs to be taken in account.

$$322\, ERC \times 400\frac{gal}{day\, ERC} = 128{,}800\frac{gal}{day}$$

$$128{,}800\frac{gal}{day} \times \frac{day}{24hr} \times \frac{hr}{60min} = 90\ \frac{gal}{min} \qquad \textit{Average Day Indoor Demand}$$

The State Rule for outdoor demand is highly variable throughout the year and is related to the amount of land irrigated, as well as, local climatological conditions. The number of ERC's that use culinary water for outdoor land irrigation in the Pleasant View water system is only the 26 lots in Pole Patch Subdivision and the 3 lots in Diamond Estates.

According to the State Rule R309-510-7(3), in order to determine outdoor water demand, an *Irrigation Zone* needs to be defined based off of the Irrigated Crop Consumptive Use Zone map prepared by the Soil Conservation Service. This map defines Pleasant View City as irrigation zone number 4. The Utah State Rule R309-510-7(3) provides a table of peak day demand and average yearly demand values for outdoor use for all irrigation zones defined in the Soil Conservation Service map. Based on the table in the State rule, the outdoor average yearly demand for zone 4 is 1.87 acre-ft/irrigated acre.

In order to determine a demand for Pleasant View City, the number of irrigated acres per ERC must be determined. This was accomplished by using aerial maps of the Pole Patch Subdivision. The average of outdoor irrigated acreage in this subdivision area used for this feasibility study is 0.20 acres. Multiplying the outdoor demand by the number of outdoor ERC's, and by the irrigated acreage in the Pleasant View water system results in an average outdoor usage of:

$$29\,ERC \times 1.87\frac{ac-ft}{irr.ac.} \times .0.20\ irr.ac. \times \frac{325851\,gal}{ac-ft} \times \frac{yr}{365\,day} = 9{,}682\frac{gal}{day}$$

$$9{,}682\,\frac{gal}{day} \times \frac{day}{24hr} \times \frac{hr}{60min} = 7\frac{gal}{min} \quad Average\ Day\ Outdoor\ Demand$$

The total average day demand on the system as required by the State rules is determined by adding the indoor and outdoor usage as follows:

$$599\frac{gal}{min} + 7\frac{gal}{min} = \mathbf{606}\frac{\mathbf{gal}}{\mathbf{min}} \qquad \textbf{Average Day Demand (Existing System)}$$

$$599\frac{gal}{min} + 90\frac{gal}{min} + 7\frac{gal}{min} = \mathbf{696}\frac{\mathbf{gal}}{\mathbf{min}} \qquad \textbf{Average Day Demand (with approved Lots)}$$

According to the DDW requirement for Average Day Demand, the Pleasant View water system should have a minimum average water demand of 606 gpm, which equates to approximately 975 AC-FT per year. In addition, the approved lots would increase the average day demand to 696 gpm, or 1,121 AC-FT per year.

Table 4.2- Pleasant View City Average Day Demand (w/Approved Lots)

Minimum Source Requirement	Ave. Demand (GPM)	Ave. Yearly Demand (MG)	Ave. Yearly Demand (AC-FT)
Existing (DDW)	696	366	1,122

4.2.2 Existing Peak Day Demands Demands

The State DDW rules define peak day indoor demand for one ERC to be 800 gallons per day, which is double the average day demand.

This results in the following demand on the system.

$$2158\,ERC \times 800\frac{gal}{day\,ERC} = 1{,}726{,}400\frac{gal}{day}$$

$$1{,}726{,}400\frac{gal}{day} \times \frac{day}{24hr} \times \frac{hr}{60min} = 1{,}198\frac{gal}{min} \quad \textit{Peak Day Indoor Demand}$$

In addition to the existing 2,158 connections, the 322 approved connections needs to be taken in account.

$$322\,ERC \times 800\frac{gal}{day\,ERC} = 257{,}600\frac{gal}{day}$$

$$257{,}600\frac{gal}{day} \times \frac{day}{24hr} \times \frac{hr}{60min} = 180\,\frac{gal}{min} \quad \textit{Peak Day Indoor Demand}$$

For outdoor peak day demand, the demand given in the DDW R309-510-7(3) for zone 4 is 3.96 gpm/irrigated acre. Multiplying this demand with the average irrigated acreage of 0.20 acres equals the peak day outdoor demand as shown below.

$$29\,ERC \times 3.96\frac{gpm}{irr.ac.} \times .20\,irr.ac. = 23\frac{gal}{min} \quad \textit{Peak Day Outdoor Demand}$$

The total peak day demand is determined from adding the indoor and outdoor demand totals as follows:

$$1{,}198\frac{gal}{min} + 23\frac{gal}{min} = \mathbf{1{,}221\,\frac{gal}{min}} \quad \boldsymbol{Total\,Peak\,Day\,Demand\,(Existing\,System)}$$

$$1{,}198\frac{gal}{min} + 180\frac{gal}{min}23\frac{gal}{min} = \mathbf{1{,}401\,\frac{gal}{min}} \quad \boldsymbol{Total\,Peak\,Day\,Demand\,(with\,approved\,lots)}$$

The calculation above shows that peak day demand to the Pleasant View water system using the DDW rules for indoor and outdoor use should be 1,221 gallons per minute on a peak day and 1,401 gallons per minute with the approved lots.

Table 4.3- Pleasant View City Peak Day Demand (w/Approved Lots)

Minimum Source Requirement	Peak. Demand (GPM)
Existing (DDW)	1,401

4.2.3 Demand Comparison DDW vs. Historical Source Production

As a check for the average day demand calculated in the section above, the historical source production data from Pleasant View City for the years 2013 and 2014 can be compared to the calculated demand from the DDW. Table 4.0 shown previously shows the average day demand for Pleasant Viw City to be 446 gpm and 420 gpm respectively for an average of 433 gpm.

The Pleasant View City historical source production data does not match well with the DDW's minimum sizing requirements. The yearly average for the last two years from historical records is 433 gpm, while the DDW calculations show 606 gpm. The historical usage is approximately 30% less than the calculated value.

Historical Peak Day Demand is more difficult to determine since the meters are not read or recorded on a daily basis. However, in reviewing the historical source demand the peak month over the last two years occurred in June 2013 at 501 gpm. The DDW drinking water calculations for Peak Day Demand is double the Average Day Demand. In Pleasant View's case double their average day demand usage (433 gpm) would equate to a Peak Day Demand of 866 gpm or 30% less than the calculated value of 1,221 gpm. The 866 gpm is still greater than the observed peak month from the historical source production data.

4.2.4 Reduction of DDW Source Sizing Requirements

The State Division of Drinking Water allows a water system to seek a reduction of sizing requirements per R309-510-5.

(1) Water systems that want to use system-specific design criteria that are below the state's minimum sizing requirements may submit a request for a reduction to the Director. Each request shall include supporting information justifying the reduction in source, storage, or pipeline sizing.

(2) Depending on the reduction being sought, the supporting information may include actual water use data representing peak day demand, average day demand for indoor and irrigation uses, fire flow requirements established by the local fire code official, etc. Each reduction request and supporting information will be reviewed on a case-by-case basis because of the wide variety of factors to be considered, such as water system configuration and size, built-in redundancy, water user type, safety factors, method and quality of data collected, water losses, reliability of the source, etc.

(3) Prior to collecting or compiling water use data for a reduction request, a public water system shall consult with the Division of Drinking Water to identify the information needed for a reduction request and to establish a data collection protocol.

(4) The data submitted for a source reduction request shall be sufficient to account for daily, seasonal, and yearly variations in source and demand.

(5) If data justifying a reduction are accepted by the Director, the sizing requirements may be reduced. The requirements shall not be less than the 90th percentile of acceptable readings.

(6) If a reduction is granted on the basis of limited water use, enforceable water use restrictions must be in place, shall be consistently enforced by the water system or local authority, and shall be accepted by the Director.

(7) The Director may re-evaluate any reduction if the nature or use of the water system changes.

In reviewing the historical source production information and being conservative a 25% reduction is reasonable. The 25% reduction is equivalent to a 300 gallons per connection per day (gpcd) compared to the DDW 400 gallons per connection per day (gpcd). The Peak Day demand with the same 25% reduction would be approximately 600 gpcd as opposed the minimum sizing requirement of 800 gpcd from the DDW.

With using the reductions listed above the comparison of the demands on the existing system with approved undeveloped lots are shown in the tables below.

Table 4.4- Pleasant View City Average Day Demand (w/Approved Lots)

Minimum Source Requirement	Ave. Demand (GPM)	Ave. Yearly Demand (MG)	Ave. Yearly Demand (AC-FT)
Existing (DDW)	696	366	1,122
Exisiting (Historical)	521	274	840

Table 4.5- Pleasant View City Peak Day Demand (w/approved lots)

Minimum Source Requirement	Peak. Demand (GPM)
Existing (DDW)	1,401
Exisiting (Historical)	1,056

4.2.5 Existing Demands Summary

In summary, without the reduction in source sizing, the Pleasant View Water System source requirement is **696 gpm, or 1,122 AC-FT per year for Average Day Demand** with the approved lots. If a reduction was allowed the Average Day Demand requirement would be **521 gpm or 840 AC-FT** per year. For **Peak Day Demand** the requirement for source sizing is **1,401 gpm**. There is insufficient meter data to determine an actual Peak Day Demand however, using the 600 gpcd reduction discussed previously yields **1,056 gpm for an estimated Peak Day Demand**. The reduction in the source sizing requirements is important to Pleasant View City as will be shown in Section 5 due to their source deficiencies. It is our recommendation that Pleasant View begin the process and data collection of requesting a reduction in the source sizing requirements immediatly.

4.3 Projected System Demand

4.3.1 Projected Average Demand

The existing average water demand on the Pleasant View system used in this feasibility study was calculated using the minimum sizing requirements from the DDW, and the historical source production information. The average demand calculations for build out will use both, and compare the difference. An assumption was made that the future connections will be similar to the existing connections in the fact secondary water will be available, thus the outdoor water source need is not included in the calculations. For reference the Future Connections Build Out table is shown.

Table 3.0- Future Connections (Build Out)

Zone	Existing Connections	Future Connections	Build Out Connections
8	26	14	40
7	9	93	102
6	210	50	260
5	179	81	260
4	252	273	525
3	252	350	602
3a	145	-	145
3b	114	-	114
2	306	56	362
1	665	666	1,331
Pleasant View City	**2,158**	**1,583**	**3,741**

The average day system demand for Pleasant View City for build out conditions within the water systems service area is from 1,257 AC-FT per year using the source reduction and 1,683 AC-FT per year using the States DDW minimum requirements. As it will be demonstrated in Section 5.0 the average day system demand is not as critical for Pleasant View as the peak day demand analysis. Table 4.7 shows the projected build out average day demands.

Table 4.7- Average Day System Demand (Build Out)

Minimum Source Requirement	Ave. Demand (GPM)	Ave. Yearly Demand (MG)	Ave. Yearly Demand (AC-FT)
Build Out (DDW)	1,044	548	1,683
Build Out (Historical)	779	410	1,257

4.3.2 Projected Peak Day Demand

The Projected Peak Day Demand estimates using the DDW minimum sizing requirements and the estimated Peak Day Demand from historical usage is shown below. Using the DDW minimum sizing requirements for indoor usage, the projected demand is 2,101 gpm and 1,582 gpm if the reduction is allowed by the Division of Drinking Water.

Table 4.8- Peak Day Demand (Build Out)

Minimum Source Requirement	Peak. Demand (GPM)
Build Out (DDW)	2,101
Build Out (Historical)	1,582

5 SOURCE ANALYSIS

The Utah Division of Drinking water has provided rules and regulations governing source capacity for each system. Rule R309-510-7 (1) states that the sources should meet water demands under two separate conditions:

1. Peak day anticipated water demand
2. Provide one year's supply of water, the average yearly demand

This section of the report will discuss the sources and their ability to meet condition 1 and 2 shown above. The average yearly demand requirement shown in condition 2 is mainly for water right purposes. A water right analysis of the Pleasant View System is not included in this scope of work, however previous Master Plans indicate that Pleasant View has adequate water rights.

The last part of this section is a discussion of the global source capacity of the system which includes a discussion of projected future demand and the ability of the sources as a whole to move water throughout the system and provide water to meet future demand.

5.1 Source Description & Capacity

Pleasant View City owns and operates four wells Alder Creek Well, Mac Wade Well, Jessie's Creek Well, and the recently developed Well #4. In 2014 Hansen Allen & Luce Engineers (HAL) performed a water source evaluation for the City. A summary of each source from the Technical Memorandum is as follows:

5.1.1 Alder Creek Well

Alder Creek Well was completed using the cable tool drilling method in 1981 to a depth of 665 feet. The well casing is perforated from 465 to 496 feet and from 590 to 645 feet below ground surface. The upper perforations are within unconsolidated gravels, boulders and clays and the lower perforations are in a fractured shale and quartzite bedrock formation. The water level probe is placed at about 530 feet below ground surface. The submersible Grundfos pump is set at about 536 feet.

In 1981, a pump test was conducted at a rate of 451 gpm for 24 hours with 25 feet of drawdown. The calculated specific capacity (flow rate divided by drawdown during pumping) for this test was 18 gpm/ft. Information on the well driller's log indicates that the well was also pumped at a rate of 201 gpm with a drawdown of 6 feet. This results in a specific capacity of 34 gpm/ft. It is common for specific capacity of a well to increase as the pumping rate decreases.

Water level and flow data for 2004-2005 and 2011-2013 were evaluated to determine specific capacity over time as summarized in Table 5.0 below. Reliable water level data for this well was not available for the 2006-20011 time period. The flow rates during 2004-2005 were consistently around 260 to 270 gpm. During most of 2011, the flow rate of the well ranged from about 140 to 180 gpm. However, from November 2011 through February 2012, the flow rate steadily declined to about 100 gpm. Flow rates have been consistently at about 100 gpm since that time until the present. The specific capacity of the well since 2011 has ranged from about 14 gpm/ft to 22 gpm/ft. This is about half of the original specific capacity at a comparable flow rate (201 gpm). This may indicate that something is happening within the Alder Creek Well to decrease its efficiency. Possible causes of this include scale buildup within the casing that blocks perforations, biological growth within the well, or other plugging mechanism. Drops in well production could also be due to the pump wearing out. However, this would not affect the specific capacity values.

Table 5.0 Alder Creek Well Flow and Specific Capacity

DATE RANGE	FLOW RATE RANGE (GPM)	SPECIFIC CAPACITY (GPM/FT)
1981	201 - 451	18 (451 gpm) – 34 (201 gpm)
2004-2005	256 - 273	water level data not available
2011-2013	97 - 180	14.1 - 21.9

From 2011 to 2013, the water level in the well dropped by about 60 feet. This decline is consistent with regional groundwater level declines, due to drought conditions. Based on readings during January 2014, the static water level in this well is already about 5 feet below the first perforations. Drawdown in the well during pumping ranges from 6 to 11 feet depending upon the duration of pumping. Drawdown of water levels within the perforations presents a risk of cascading water which can cause problems with both the pump and the well.

Based on the available data, it is believed that the well is showing a typical response to declining water levels in the aquifer due to extreme drought conditions. However, the decline in specific capacity at flow rates less than 200 gpm also indicates that the efficiency of the well may have declined. A possible course of action to increase the efficiency of the Alder Creek Well would be to rehabilitate the well through well casing scrubbing and additional well development. This may increase the flow rate within the well while maintaining a similar drawdown. This action may require the well to be out of service for 4 to 8 weeks. It should be noted that it is not certain that these actions will result in significant increase in capacity.

5.1.2 Mac Wade Well

Mac Wade Well was completed using the cable tool drilling method in 1968 to a depth of 530 feet. The well casing is perforated from 200 to 410 feet and from 440 to 520 feet below ground surface. The upper perforations are within unconsolidated gravels and clays and the lower perforations are in a fractured quartzite bedrock formation. The water level probe is placed at about 200 feet below ground surface. The submersible pump is believed to be set at about 200 feet.

In 1968, a pump test was conducted at a rate of 450 gpm for 101 hours with 90 feet of drawdown. This represents a specific capacity of 5 gpm/ft. Water level and flow data for 2004-2005 and 2011-2013 were evaluated to determine specific capacity over time as summarized in Table 2 below. The flow rates appear to be lower than when the well was originally constructed but have been fairly consistent since 2004. Generally, it appears that the specific capacity of the well has remained fairly consistent with some fluctuations based on how often and how long the well is pumped. The lowest specific capacities (4.1 to 4.4 gpm/ft) and flow rates (317 to 325 gpm) occurred during October 2012 through December 2012 when water levels were at their lowest points during the period of record.

Table 5.1 Mac Wade Well Flow and Specific Capacity

DATE RANGE	FLOW RATE RANGE (GPM)	SPECIFIC CAPACITY (GPM/FT)
1968	450	5
2004-2005	350 - 385	5.9 - 7.5
2011-2013	317 - 397	4.1 - 6.2

In 2011, after a relatively good winter in terms of precipitation, the static water level was more than 120 feet above the water level probe. However, precipitation over the next two years was well below normal. In these years, the static water level dropped to around 80 to 90 feet above the water level probe. During pumping at flow rates from about 350 to 370 gpm, the typical drawdown in the well is from 55 to 65 feet depending upon how long the well is pumped. The exception to this was during the period of October 2012 through December 2012 when the drawdown ranged from 72 to 77 feet. A possible explanation for this may be that the well was pumped for longer durations during this period.

Based on the available data, it is believed that the well is showing a typical response to declining water levels in the aquifer due to extreme drought conditions. At lower water levels, the pump cannot lift as much water because it has to lift it against a higher elevation difference. Water systems facing declining well water levels sometimes can deal with this issue by modifying their existing pump or replacing it with a new pump to bring the pumping capacity back up to its original flow rate. However, the current pumping water level in the Mac Wade Well is within 10 feet of the top perforated interval. Increasing the pump capacity would likely draw the water down into the perforations, which might result in cascading water. This can result in problems to both the well and the pump. Also, based on comments from City staff, this well produces a lot of sand when the water level is drawn down to the perforations.

5.1.3 Jessie's Creek Well

Jessie's Creek Well was completed in 2004 using the reverse circulation rotary drilling method in 2004 to a depth of 1,500 feet. Approximately 812 feet of wire wrap screens and slotted casing were installed at various intervals ranging from 487 to 1,488 feet below ground surface. The well is completed into fractured limestone, quartzite, and shale bedrock formations. The water level probe is placed at about 800 feet below ground surface. The line-shaft turbine pump is set between 800 and 850 feet below ground surface.

In 2004, a pump test was conducted at a rate of 1,000 gpm for 24 hours with about 640 feet of drawdown. The calculated specific capacity for this test was 1.6 gpm/ft. Based on water level and pumping information gathered from the City's SCADA system and based on information provided by City staff, the pumping water level does not stabilize. For example, on February 8, 2014, the well pumped for about 1 hour and 40 minutes. The beginning pumping rate was 526 gpm. The ending pumping rate was 493 gpm with a drawdown of 49 feet. However, if the well pumps for about 6 hours, the typical ending flow rate is about 200 gpm with a drawdown of about 90 feet. Obviously this well performs differently than the City's other two wells.

Another difference with the Jessie Creek well is that it takes a long time to recover to its original water level after being pumped. In a typical well, if well pumping and recharge are balanced, the well will recover fully within the same duration that the well was pumped. For instance, if a well pumped for 24 hours, it should be fully recovered 24 hours after it shuts down. After the Jessie Creek well pumped for 1 hour and 40 minutes on February 8, 2014, it took a day and a half to recover within 2 feet of the original water level. During this pumping cycle, the well pumped about 50,600 gallons but took a day and a half to recover. This results in an average recharge rate to the well of only about 25 gpm.

The Jessie's Creek Well is performing like a fractured bedrock well (which it is) with limited recharge. Over short pumping durations, the well can produce a large pumping rate. However, because there is limited recharge to the well, large pumping rates cannot be sustained. We estimate that the recharge rate of Jessie's Creek Well may only be able to sustain roughly 40 ac- ft/year in annual withdrawals. Further study of the pumping and recovery patterns of this well is recommended to better determine the safe yield of this well and how it could be best used to meet the City's needs.

Static water level fluctuations in this well have shown similar fluctuations as in the Mac Wade and Alder Creek Wells.

5.1.4 Well #4

Well # 4 was recently completed with the following information coming from the Delineation Report for the Drinking Water Source Protection Plan for Pleasant View City Well #4 prepared by Cascade Water Resources November 2014.

Well #4 was recently completed in 2015 using the DR method and the areas for perforation were determined by geologic logging of the well in addition to a gamma log of the well. The well was drilled to a depth of 535'. At this point the casing could not be advanced any more. Bedrock was not encountered in this well. The well is in drilled in gravel, silty gravel, clayey gravel, and clay. The casing is 8" in diameter and is perforated at the following levels: 170 -200, 270 -290, 375 – 390, 415 – 445, and 490 -500. The static water level in the well is 82'.

An aquifer test was conducted on Well 4 during June and July of 2014. During the test water levels were monitored in Pleasant View City Wells 4 and Alder Creek. In addition a transducer was installed in the nearby Blanchard Well which is screened in the same aquifer. The test pumped for a total of 90 hours, pumping the final flow rate of 300 gpm for 67.5 hrs. During this time a total drawdown of 75.44 feet was observed in the production well, 4.43 feet of drawdown in the Blanchard Well, and no drawdown in the Alder Creek Well.

The DDW definition of safe yield is 2/3 the pump tested flow of a new well in a 24 hour test. With the test completed at 300 gpm this would put the DDW safe yield at 200 gpm. With all of the information available in the aquifer, 200 gpm is much too high of yield for this well. There are there major concerns with the sustainability of this well:

1- Of greatest concern are the decreases in the water table in Alder Creek and Mac Wade Wells with only minimal extractions.
2- The limited alluvial aquifer with outcrop both to the south and north of the well.
3- The limited recharge area above the well. The recharge basin is very limited.

The short term safe yield would be 300 gpm, with a long term safe yield of 60 gpm. The well is equipped with a pump capacity to pump 300 gallons per minute and will be monitored yearly to review the long term safe yield of the well.

5.1.5 Alder Creek Springs

The flow from Alder Creek Springs fluctuates on both a seasonal and annual basis depending upon recharge. Typically, the flow rate increases rapidly from February through May during the snowmelt season, and then decreases fairly rapidly until August or September. The flow then continues to decrease at a slower rate through the fall until recharge begins to increase during the winter. In 2004-2005 when precipitation was above normal, the flow rate ranged from about 160 gpm to about 600 gpm. In 2011, another good water year, the flow rate ranged from about 160 gpm to about 560 gpm. Spring flow rates in 2012 (precipitation below normal) ranged from about 120 gpm to about 270 gpm. Spring flow rates in 2013 (second year of drought) were further reduced to a range of 100 gpm to 200 gpm.

The flow rate fluctuations of the Alder Creek Springs are typical of the way that most springs respond to cycles of high and low recharge to the contributing aquifer. Groundwater level declines resulting in diminished spring flows are a regional issue.

5.1.6 Little Missouri Spring

No information was available for Little Missouri Spring. It is understood that this spring flows at a rate of about 30 gpm.

5.1.7 Source Summary

SEI met with Pleasant View City staff to review the findings of the HAL technical memorandum and agreed with the assessment of the existing sources. A summary table of the existing source capacity can be found in Table 5.2.

Table 5.2 Existing Source Capacity

Water Source	Min. Flow Rate Capacity (gpm)	Yearly Volume Capacity (AC-FT)	Short Term Capacity Peak Day (gpm)
Mac Wade Well	357	576	397
Jesse Creek Well	25	40	100
Alder Creek Well	100	161	140
Well #4	60	97	300
Little Missouri Spring	30	48	30
Alder Creek Spring	120	194	120
Total	**692**	**1,116**	**1,087**

5.2 Existing System Source Adequacy Analysis

The Pleasant View Water System has adequate source capacity for the average day demand and the average yearly demand requirements for its existing system and the approved lots as shown in the following tables. This is true for both the demand calculated using the DDW minium requirements and the reduction based on historical usage.

Table 5.3 Existing Source Capacity Analysis Ave. Day Demand (2,158 ERC's)

Minimum Source Requirement	Ave. Demand (GPM)	Ave. Yearly Demand (MG)	Ave. Yearly Demand (AC-FT)
Exisiting (DDW)	605	318	977
Existing (Historical)	456	240	736
Existing Source Capacity	692	364	1,116
Source Capacity DDW (Surplus/Deficit)	87	45	140
Source Capacity Historical (Surplus/Deficit)	236	124	380

Table 5.4 Existing Source Capacity Analysis Ave. Day Demand (2,480 ERC's)

Minimum Source Requirement	Ave. Demand (GPM)	Ave. Yearly Demand (MG)	Ave. Yearly Demand (AC-FT)
Exisiting (DDW)	696	366	1,122
Existing (Historical)	521	274	840
Existing Source Capacity	692	364	1,116
Source Capacity DDW (Surplus/Deficit)	-4	-2	-6
Source Capacity Historical (Surplus/Deficit)	171	90	276

When considering Peak Day Demand the Pleasant View Water system is deficient in capacity using the DDW minimum source sizing rules. If Pleasant View is able to reduce to the source requirement to 600 gpcd as discussed in Section 3.0 it is currently at capacity for its existing 2,158 connections. The system is is deficient in capacity to be able to accommodate the 322 additional undeveloped approved lots within its water system.

Compared to previous source analysis on the system, two main changes have occurred. The first change is the addition of Well #4 into the system. The second change has occurred in the Jesse Creek Well, this well has seen a large drop in its capacity over time as discussed in section 5.1.4. The addition of the Well # 4 and the reduction in the Jesse Creek Well have in essence canceled each other out.

Table 5.5 Existing Source Capacity Analysis Peak Day Demand (2,158 ERC's)

Minimum Source Requirement	Peak. Demand (GPM)
Existing (DDW)	1,222
Existing (Historical)	922
Existing Source Capacity	**1,087**
Source Capacity DDW (Surplus/Deficit)	-135
Source Capacity Historical (Surplus/Deficit)	165

Table 5.6 Existing Source Capacity Analysis Peak Day Demand (2,480 ERC's)

Minimum Source Requirement	Peak. Demand (GPM)
Existing (DDW)	1,401
Existing (Historical)	1,056
Existing Source Capacity	**1,087**
Source Capacity DDW (Surplus/Deficit)	-314
Source Capacity Historical (Surplus/Deficit)	31

In summary the existing water system is at capacity on an Average Day Demand basis or a slight surplus if the minium source demand reductions are allowed. On a Peak Day Demand Basis the sources are deficient 314 gpm based on the minimum source requirements by DDW or just at capacity if the minium source demand reduction based on historical usage is allowed.

5.3 Projected Source Adequacy Summary

Pleasant View's culinary water system is in need for additional source if growth is to occur. The system will be deficient 141 to 567 AC-FT of water yearly to be able to meet the Average Day Demand of water system at build out of 3,741 connections. This is shown in table 5.7.

Table 5.7 Build Out Source Capacity Analysis Peak Day Demand (3,741 ERC's)

Minimum Source Requirement	Ave. Demand (GPM)	Ave. Yearly Demand (MG)	Ave. Yearly Demand (AC-FT)
Build Out (DDW)	1044	548	1,683
Build Out (Historical)	779	410	1257
Existing Source Capacity	692	364	1,116
Source Capacity DDW (Surplus/Deficit)	-352	-185	-567
Source Capacity Historical (Surplus/Deficit)	-87	-46	-141

Pleasant View's culinary water system large deficiency is source capacity for a peak day demand scenario. The system will be deficient 495 to 1,014 gpm of peak day source capacity to be able to meet the water system build out of 3,741 connections. This is shown in table 5.8.

Table 5.8 Build out Source Capacity Analysis Peak Day Demand (3,741 ERC's)

Minimum Source Requirement	Peak. Demand (GPM)
Build Out (DDW)	2,101
Build Out (Historical)	1,582
Existing Source Capacity	**1,087**
Source Capacity DDW (Surplus/Deficit)	-1,014
Source Capacity Historical (Surplus/Deficit)	-495

5.4 Source Evaluation Summary

In summary the Pleasant View water system has adequate source capacity for an average demand or yearly volume requirements to meet the DDW minimum source sizing requirements. The **existing system** is deficient in the peak day demand minimum source sizing requirements by **314 gpm** to able to meet the demands within its water system including the lots that have been approved to be built. If a reduction of the minimum source sizing requirement was allowed by the DDW to **600 gpcd** the existing system would have **a slight surplus of 31 gpm** to be able to supply water to all the approved lots.

The projected water usage with build out of the system calculated in section 3 the system will be **deficient 141 to 567 AC-FT of yearly volume** and **495 to 1,014 gpm of Peak Day source capacity**.

Based on the analysis of this Section, it is our recommendation to begin the process of reducing the minimum source sizing requirements while evaluating the different options presented in the following sections of obtaining additional source.

6 STORAGE ANALYSIS

All culinary water systems are required to have water storage capacity. Storage capacity is used in the case that water is not available immediately from the sources providing water to the system. A storage reservoir also mitigates the instantaneous demands of the system which will vary dramatically throughout the day. The idea is that if a source goes down or some other emergency happens that the water system will still be able to provide water to the users and even be able to provide adequate fire flow throughout the system.

The Utah Division of Drinking water has provided rules and regulations governing the amount of storage required for each system. Rule R309-510-8 states that each storage facility shall provide the following:

1. Equalization storage volume, to satisfy peak day demands for water for indoor use as well as outdoor use,
2. Fire suppression storage volume, if the water system is equipped with fire hydrants and intended to provide fire suppression water, and
3. Emergency Storage, if deemed appropriate by the water supplier or Executive Secretary, to meet demands in the event of an unexpected emergency situation such as a line break or a treatment plant failures.

6.1 Storage Facility Description and Capacity

This section provides a detailed description of each of the water storage facilities in the Pleasant View water system. This section also discusses the size and capacity of each facility along with existing redundancy infrastructure associated with each facility.

Table 6.0- Pleasant View City Storage Facility Summary

Water Storage	Capacity	High Water Elevation	Zone
Jesse Creek	800,000	5,517	8
Alder Creek Reservoir 1	500,000	5,340	7
Macs Reservoir	200,000	5,286	6
Alder Creek Reservoir 2	200,000	5,288	6
Well #4 Tank	500,000	5,292	6
500 West Reservoir	250,000	4,714	3
Little Missouri Reservoir	70,000	4,714	3b
Total	**2,520,000**		

6.2 Global Storage Analysis

As stated previously, the Utah Division of Drinking Water Rules have water storage requirements that must be met for all public water systems. The water system shall have sufficient equalization, fire suppression, and emergency storage for all areas of the system.

6.2.1 Existing Storage Requirements

Equalization Storage Volume

The state rules require all water systems to have equalization storage volume to satisfy peak day demands for water for indoor use as well as outdoor use. State Rule R309-510-8 (2b) identifies the criteria for determining equalization storage. For indoor use, the state rule refers to Table 510-4 which states that the required equalization storage volume for residential connections is 400 gallons, and that the required equalization storage volume for non-residential connections is 400 gallons per ERC. The number of ERC's for the Pleasant View system was determined in Section 3 of this feasiblity study.

The criteria for determining the equalization storage requirement for outdoor water use is given in State Rule R309-510-8 (2c). The Rule refers to Table 510-5 which uses the mapped zone from the Irrigated Crop Consumptive Use Zone map prepared by the Soil Conservation Service. This map shows Pleasant View as Zone 4. The equalization storage volume requirement for map zone 4 is 2,848 gallons per irrigated acre.

The total equalization storage requirement for the entire Pleasant View water system is shown in Table 6.1 below. The equalization storage includes required storage for both indoor and outdoor use. As shown in the table, the **total equalization storage** requirement based off of the State Rules is **1.0 million gallons (MG)**. This storage requirement is combined with the storage requirement for fire flow and emergency storage to determine total required storage, which is also shown in Table 6.1.

Fire Suppression Storage Volume

Utah State Rule R309-510-8(3) states, "The design engineer shall consult with the local fire suppression authority regarding needed fire flows in the area under consideration." The North View Fire Marshal has determined that for most storage areas, the required fire flow requirement in Pleasant View shall be 2750 gpm for a duration of 2 hours. This requirement results in a **fire suppression volume** requirement of **330,000** gallons.

Emergency Storage Volume

Emergency storage volume requirement is more arbitrary than the other requirements. Utah State Rule R309-510-8 (4) states, "Emergency storage shall be considered during the design process. The amount of emergency storage shall be based upon an assessment of risk and the desired degree of system dependability. The Executive Secretary may require emergency storage when it is warranted to protect public health and welfare." The rule also gives the guidance that, "It is advisable to provide water storage for emergency situations, such as pipeline failures, major trunk main failures, equipment failures, electrical power outages, water treatment facility failures, raw-water supply contamination, or natural disasters. Generally, the need for emergency storage shall be determined by the water supplier and design engineer."

The emergency storage requirement for this feasibility study is 15% of the indoor and outdoor equalization storage volume. The 15% of the indoor and outdoor equalization storage volume for **emergency storage** is **151,021 gallons**.

The total **existing storage requirement** for the Pleasant View City water system including equalization, fire suppression, and emergency storage is **1,487,831 (Gal.) or 1.49 MG.** As shown in

Table 6.0 above, the total storage capacity for the Pleasant View system as a whole is **2.52 MG.** This analysis shows that the system has enough storage globally. With the majority of the storage located in higher elevations the existing tanks serve the entire water system very well.

Table 6.1- Existing Storage Volume Requirements (Gal.)

Existing Minimum Storage Requirement	Storage Volume (Gal.)
Indoor	992,000
Outdoor	14,810
Fire Suppression	330,000
Emergency Storage	151,021
Total Storage Required	**1,487,831**
Existing Storage	2,520,000
Surplus/Deficit	**1,032,169**

6.2.2 Projected Storage Requirements

The storage volume requirements can be projected to the future build out conditions. The projected storage volume requirements will help the City determine potential future infrastructure needs and the ability of the system as a whole to meet future storage requirements. The calculations for the water service area build out (3,741 ERC's) is shown in the table below. As shown below Pleasant View City has adequate storage for the projected build out.

Table 6.2- Build Out Storage Volume Requirements (Gal.)

Build Out Minimum Storage Requirement	Storage Volume (Gal.)
Indoor	1,496,400
Outdoor	14,810
Fire Suppression	330,000
Emergency Storage	226,682
Total Storage Required	**2,067,892**
Existing Storage	2,520,000
Surplus/Deficit	**452,109**

6.3 Storage Analysis Summary

The Pleasant View culinary water system has a surplus of **1.03 MG** of storage for its existing system including the approved lots. The system has a **0.45 MG** of surplus storage for the Build-Out conditions described in Section 3.0. The excess storage capacity has helped Pleasant View City with its deficiencies in Peak Day Demand source capacity. In essence since the system has adequate capacity on a yearly basis or average day demand basis, the excess storage has supplied the additional source for the peak day demand periods. The majority of the storage for the system is located at higher elevations which allows the tanks to be used for the entire system and a separate local storage analysis will not be necessary for the system.

7 ADDITIONAL SOURCE FEASIBILITY ANALYSIS

The main purpose for this study is to identify the feasibility of future source options for the City of Pleasant View. The previous sections of this study identified and quantified the deficiencies in source in both the existing system and projected build out conditions. This Section will identify potential source options and quantify the feasibility of the future sources hydraulically and economically. The available options for the City included:

- Drilling new wells
- Whole sale water from Weber Basin through Bona Vista
- Whole sale water direct from Weber Basin
- Whole sale water from North Ogden
- Whole sale water from Bear River Water Conservancy District.

The last two options of receiving whole sale water from North Ogden and Bear River Water Conservancy District were eliminated from further analysis as both providers would only be willing to sell water on a short-term basis as both entities will require additional source in the future to meet their own needs. The other three options will be further detailed in this section.

In order to compare the different options the capital costs associated with each projects will be assumed to be financed for 20 years at a 3% interest rate. The funding package is similar to what other systems have received from the DDW and on the public market recently.

7.1 Additional Wells

In drilling new wells it is important to understand the hydrogeology of the area to understand the risks involved with drilling wells. In 2011 Pleasant View City commissioned Hansen Allen & Luce Engineers to conduct a New Well Hydro geologic Evaluation a summary of their findings is as follows:

Groundwater tributary to the Pleasant View City area originates as infiltration from precipitation in the mountains northeast of the City. Ground water then travels in a southwestern direction toward the valley. In the mountain areas east of the main trace of the Wasatch Fault, groundwater flow is primarily through faults, fractures, and fissures in the bedrock formations. Using the average annual precipitation in the mountains northeast of Pleasant View, and an assumption of 50% of precipitation recharging the groundwater, ***the estimate recharge available for water sources in the Pleasant View area is about 6,600 ac-ft/yr.***

In the foothills, bedrock formations are overlain by unconsolidated deposits with a thickness ranging from more than 300 feet near the main trace of the Wasatch Fault to less than 100 feet near a fault running roughly parallel to Pleasant View Drive. This fault marks the boundary between the shallow bedrock of the foothills and the main valley unconsolidated aquifer. Groundwater flow through the foothills aquifer is through a combination of the unconsolidated deposits and the underlying bedrock formations. The proposed well site and the four identified City parcels are all located within the foothills aquifer area.

Based on geologic mapping by Crittenden and Sorensen (1985) and Montgomery (1995), the primary bedrock formations in the foothills aquifer area include the Tintic Quartzite, the Maxfield Limestone, and the Ophir formation. The Ophir Formation primarily consists of shale. The Maxfield Limestone consists of limestone interbedded with shale. The Tintic Quartzite primarily consists of quartzite. Because of the many faults throughout the foothills, it is expected that the bedrock formations are fractured providing a secondary porosity for increased *potential groundwater flow. Because of their brittle nature, quartzite formations tend to form open, interconnected fracture systems when folded and faulted. Therefore, it is believed that the Tintic Quartzite will provide the best potential for groundwater development of these three formations. Shale typically acts as a barrier to groundwater flow and is less likely to form open, interconnected fracture systems. As a result, the Ophir Formation and the Maxfield Limestone have a lower potential for development of groundwater.*

Typically, the best potential aquifers for groundwater development are unconsolidated sands and gravels. However, the potential success of a new well in a fractured bedrock aquifer is dependent upon the density of fractures in the formation, the width of the fracture openings, and the interconnectedness of the fractures. A critical aspect to a successful well is whether a major fracture system is intercepted by the well. It is possible to "miss" a major fracture system by only a few feet and end up with a dry hole. However, if the fracture systems are intercepted very successful well could result. Because of these issues, drilling a well in bedrock is considered very risky.

As the City is aware after drilling the recent Well #4, drilling wells in the Pleasant View City area comes with risks. However, recharge water availability in the area indicates that area can sustain more wells and should be large enough to sustain the City to its build out conditions. The HAL technical memorandum estimates the recharge to be 6,600 AC-FT per year. The City currently uses approximately 735 AC-FT per year, with the DDW minimum source requirement of 1,122 AC-FT per year. The estimated build out yearly volume using the DDW source minimums will be 1,683 AC-FT. This is well short of the 6,000 AC-FT estimated re-charge for the area. The last culinary water master plan completed for the City (Culinary Water Master Plan & Impact Fee Study 2009 by Jones and Associates) also indicates that the City owns sufficient water rights (4,591 AC-FT) for any additional wells that are drilled.

In order to perform a feasibility study on new wells a number of assumptions will need to be made regarding location, performance, and how it hydraulically fits into the existing water system. An effort has been made to quantify the demands by pressure zone to ensure that the water sources can locally and globally meet the water systems demands. Table 7.0 shows the water demand by pressure zone using the DDW minimum source requirements. Table 7.1 shows the water demand by pressure zone using the 25% reduction from historical usage.

Table 7.0 DDW Source Demands by Pressure Zone

Zone	Existing Connections	Future Connections	Build Out Connections	Yearly Volume AC-FT	Peak Day Demand (GPM)
8	26	14	40	17.9	22.2
7	9	93	102	45.7	56.7
6	210	50	260	116.5	144.4
5	179	81	260	116.5	144.4
4	252	273	525	235.2	291.7
3	252	350	602	269.7	334.4
3a	145	-	145	65.0	80.6
3b	114	-	114	51.1	63.3
2	306	56	362	162.2	201.1
1	665	666	1,331	596.4	739.4
Pleasant View City	**2,158**	**1,583**	**3,741**	**1,676**	**2,078**

Table 7.1 Historical Source Demands by Pressure Zone

Zone	Existing Connections	Future Connections	Build Out Connections	Yearly Volume AC-FT	Peak Day Demand (GPM)
8	26	14	40	13.4	16.7
7	9	93	102	34.3	42.5
6	210	50	260	87.4	108.3
5	179	81	260	87.4	108.3
4	252	273	525	176.4	218.8
3	252	350	602	202.3	250.8
3a	145	-	145	48.7	60.4
3b	114	-	114	38.3	47.5
2	306	56	362	121.6	150.8
1	665	666	1,331	447.3	554.6
Pleasant View City	**2,158**	**1,583**	**3,741**	**1,257**	**1,559**

Pressure Zones 8-4 have the majority of the storage and wells within the water system which feeds the lower zones of 3-1 through PRVs. There are two storage reservoirs that feed Zone 3 and below, Little Missouri and 500 West, which are relatively small 250,000 gallons and 70,000 gallons respectively. The only source located in the lower zones is the Little Missouri Spring at 30 gpm. Roughly 30% of the connections are in the higher zones and 60% of the connections are in the lower zones. This trend continues in the build out projections, even though most of the unpopulated land mass is in the upper zones the zoning in these areas are a lot less dense than the zoning in the lower zones. If a future well was located in the higher zones it would be able to pump directly into the system since it would be able to feed most of the zones. A future well located in the lower zones would need to pump into at least zone 3 tanks and more than likely have a longer transmission line. These two alternatives are analysed further in next sub-sections.

7.1.1 Higher Elevation Wells

Since Pleasant View City has a surplus of storage capacity and the demand could be regulated with the tanks and other wells for this feasibility study it is assumed the well would pump directly into the system. It is understood that due to the hydro geography in the area it may be difficult to locate a suitable location to drill a well. To help mitigate the risk of drilling a poor producing well it is recommended that test drilling be conducted to locate a well location. In the cost analysis it is assumed that (3) test wells be drilled to locate a suitable location. The cost analysis also assumes a minimum of ¾ of mile of transmission line to tie into the existing system. In order to compare to other options a production of 200 gpm was assumed for a proposed well. According to the HAL technical memorandum a high producing well in the area would range from 500 gpm to 700 gpm, a medium producing well 200-500 gpm, and low producing well to be 0-200 gpm. To be conservative 200 gpm was chosen for the feasibility analysis as the production of the well. Table 7.2 shows the opinion of probable cost along with O&M costs for a proposed will in the upper pressure zones.

Table 7.2 Engineers Opinion of Probable Cost Proposed Well (Upper)

SUNRISE ENGINEERING, INC.

Opinion of Probable Costs

Project:	Pleasant View City Source Feasibility Study	Project No:	
	Proposed New Well	Date:	
Owner:	Pleasant View City	By:	Cliff Linford P.E.

ITEM NO.	Item	Quantity	Unit	Unit Price	AMOUNT
	Pleasant View Proposed New Well				
1	Land	1	LS	$ 100,000.00	$ 100,000.00
2	Exploratory Drilling	3	EA	$ 150,000.00	$ 450,000.00
3	Well House	1	LS	$ 175,000	$ 175,000.00
4	Underground Utilities	3950	LF	$ 110	$ 434,500.00
5	Mobilization	1	LS	$ 35,000	$ 35,000.00
6	Well Drilling	600	LF	$ 370	$ 222,000.00
7				**Subtotal**	**$ 1,416,500.00**
8	**Professional Services**				
9	Hydrogeology Evaluation	1	LS	$ 20,000	$ 20,000.00
10	Well Drilling Design & CM	1	LS	$ 35,000	$ 35,000.00
11	Well House & Utility Design	1	LS	$ 51,560	$ 51,560.00
12	Construction Management	1	LS	$ 51,560	$ 51,560.00
13				**Subtotal**	**$ 158,120.00**
14				**Total Capital Cost**	**$ 1,574,620.00**
15	**Pleasant View O&M (Per Year)**				
16	Power Costs	1	LS	$ 12,000	$ 12,000
17	System O&M	1	LS	$ 5,000	$ 5,000
18				**Subtotal**	**$ 17,000**

Table 7.3 shows the calculations and $ per AC-FT and $/1,000 gallon cost of the water produced from a new well using the financing packaged referenced in Section 7.0.

Table 7.3 Cost of Water for Proposed New Well (Upper Zone)

Component	$/Ac-Ft	$/Kgal
Pleasant View System New Well	$ 352.80	$ 1.08
Pleasant View O&M	$ 56.67	$ 0.17
	$ 409.46	**$ 1.26**

7.1.2 Lower Elevation Wells

A lower elevation well will be very similar to the higher elevation well other than the transmission line which likely be longer, and the horsepower for the well will need to be higher to lift the water into the elevation of Zone 3. The costs of the lower well option is shown in Table 7.4.

Table 7.4 Engineers Opinion of Probable Cost of Proposed Well (Lower)

SUNRISE ENGINEERING, INC.

Opinion of Probable Costs

SUNRISE ENGINEERING

Project: Pleasant View City Source Feasibility Study
Proposed New Well (Lower Zone)
Owner: Pleasant View City

Project No:
Date:
By: Cliff Linford P.E.

ITEM NO.	Item	Quantity	Unit	Unit Price		AMOUNT	
	Pleasant View Proposed New Well						
1	Land	1	LS	$	100,000.00	$	100,000.00
2	Exploratory Drilling	3	EA	$	150,000.00	$	450,000.00
3	Well House	1	LS	$	200,000	$	200,000.00
4	Underground Utilities	7920	LF	$	110	$	871,200.00
5	Mobilization	1	LS	$	35,000	$	35,000.00
6	Well Drilling	600	LF	$	370	$	222,000.00
7					**Subtotal**	**$**	**1,878,200.00**
8	**Professional Services**						
9	Hydrogeology Evaluation	1	LS	$	20,000	$	20,000.00
10	Well Drilling Design & CM	1	LS	$	35,000	$	35,000.00
11	Well House & Utility Design	1	LS	$	88,496	$	88,496.00
12	Construction Management	1	LS	$	88,496	$	88,496.00
13					**Subtotal**	**$**	**231,992.00**
14					**Total Capital Cost**	**$**	**2,110,192.00**
15	**Pleasant View O&M (Per Year)**						
16	Power Costs	1	LS	$	15,000	$	15,000
17	System O&M	1	LS	$	5,000	$	5,000
18					**Subtotal**	**$**	**20,000**

Table 7.5 below uses the opinion of probable costs above to determine $ per AC-FT and $/1,000 gallon cost of the water produced from a new well.

Table 7.5 Cost of Water for Proposed New Well (Lower Zone)

Component		$/Ac-Ft		$/Kgal
Pleasant View System New Well	$	472.79	$	1.45
Pleasant View O&M	$	66.67	$	0.20
	$	**539.46**	**$**	**1.66**

7.2 Weber Basin Whole Sale

As mentioned in Section 7.0 Weber Basin Water Conservancy District is the only whole sale water provider in the area that has water available to sell to Pleasant View City. Weber Basin Water does not have a direct connection to Pleasant View City and is unable to serve the culinary water system without upgrades to the system or going through Bona Vista due to the fact, that Pleasant View City's system is higher in elevation Weber Basin sells it water in tiers and by a yearly volume. Weber Basin only has a few hundred Acre-Feet of water left in tier 2. Tier 2 water sells for $351.78 per Acre Foot or ($1.08 per 1,000 gallons). Tier 2 water will be unavailable after this year. Tier 3 Water sells for $531.00 per Acre Foot or ($1.63 per 1,000 gallons). It is anticipated that Tier 3 Water will be available for another 10 years. Weber Basin sells the water on an annual basin and it's a use or lose contract. Weber Basin also restricts the flow rate in which a customer is able to take water by charging more for a peaking factor. This means if Pleasant View City purchases 300 AC-FT per year (186 gpm) of water from Weber Basin, Pleasant View City would be able to use a peaking factor of 2.0 or 372 gpm for a peak day use without incurring a penalty.

7.2.1 Weber Basin Whole Sale through Bona Vista

Weber Basin Water Conservancy District does not have any connections to Pleasant View's Water System. Weber Basin owns a couple of wells that pump directly into Bona Vista's water system. SEI contacted Bona Vista to see if they would be able to purchase water from Weber Basin and convey it to Pleasant View through a wheeling agreement. Hydraulically, the majority of Bona Vista's water system is at lower elevation and pressure than Pleasant View's system and is unable to connect directly to Pleasant View's water system. For fire flow storage Bona Vista does have a tank located at higher elevation in which they pump up to the tank and the reduce back down to serve their system. The tank and pump station are shoen in figure 7.0. This 1.0 MG tank elevation is able to serve Pleasant View's system from Zone 3a -1. A hydraulic profile of Pleasant Views system with Bona Vista's 1.0 MG tank is shown in figure 7.1. The 1.0 MG tank is a conventional reinforced concrete tank built in 1998 and is in good repair. The pump house and transmission line were also constructed during the same time period and are also in good repair. The pump house has the capability to pump 1,100 gallons per minute at 370 ft of TDH. The pumps are 125 HP. A site visit to the pump house and tank site revealed that both are in good condition.

Figure 7.0- Pleasant View City Water System with Bona Vista Infrastructure

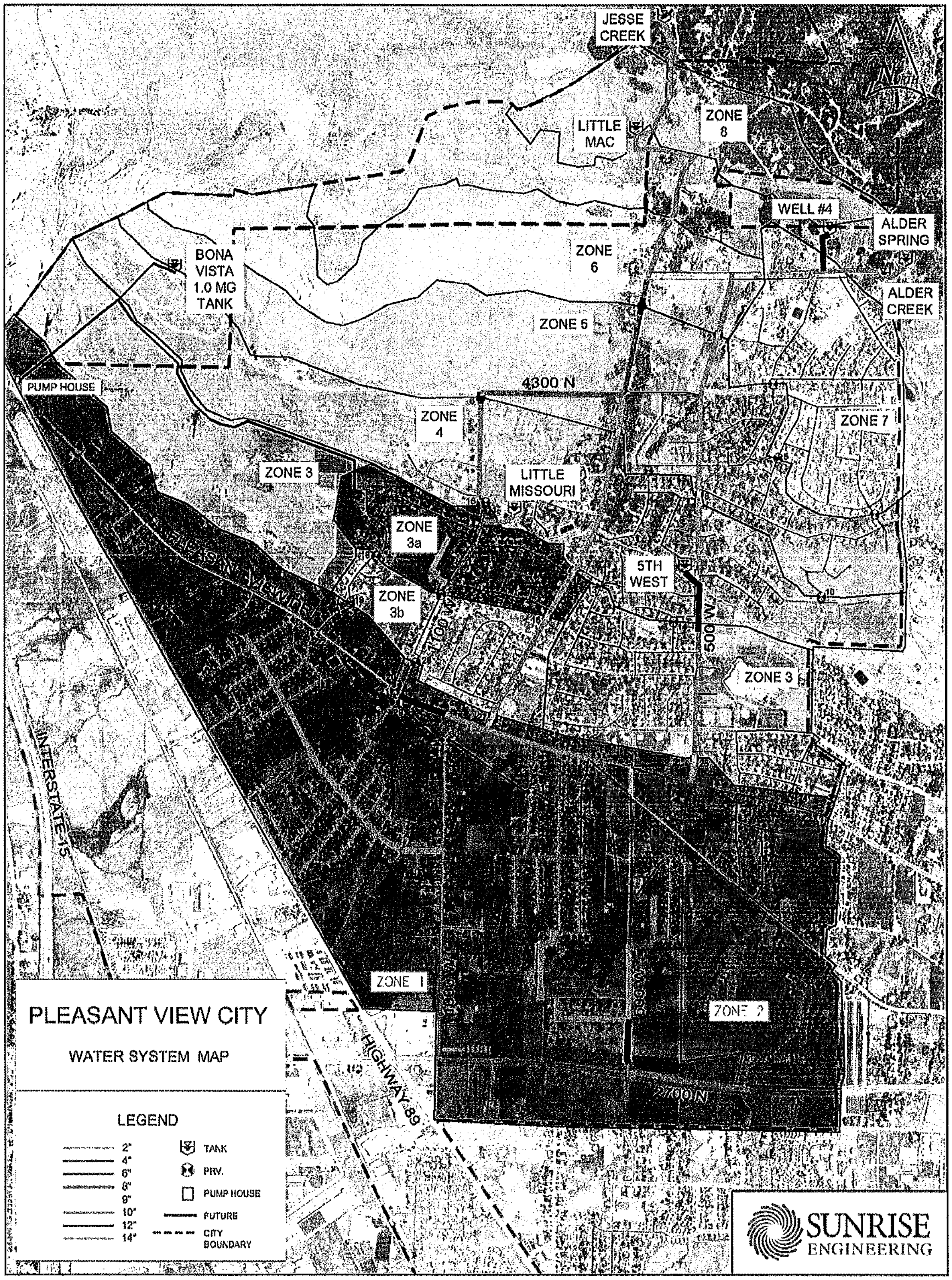
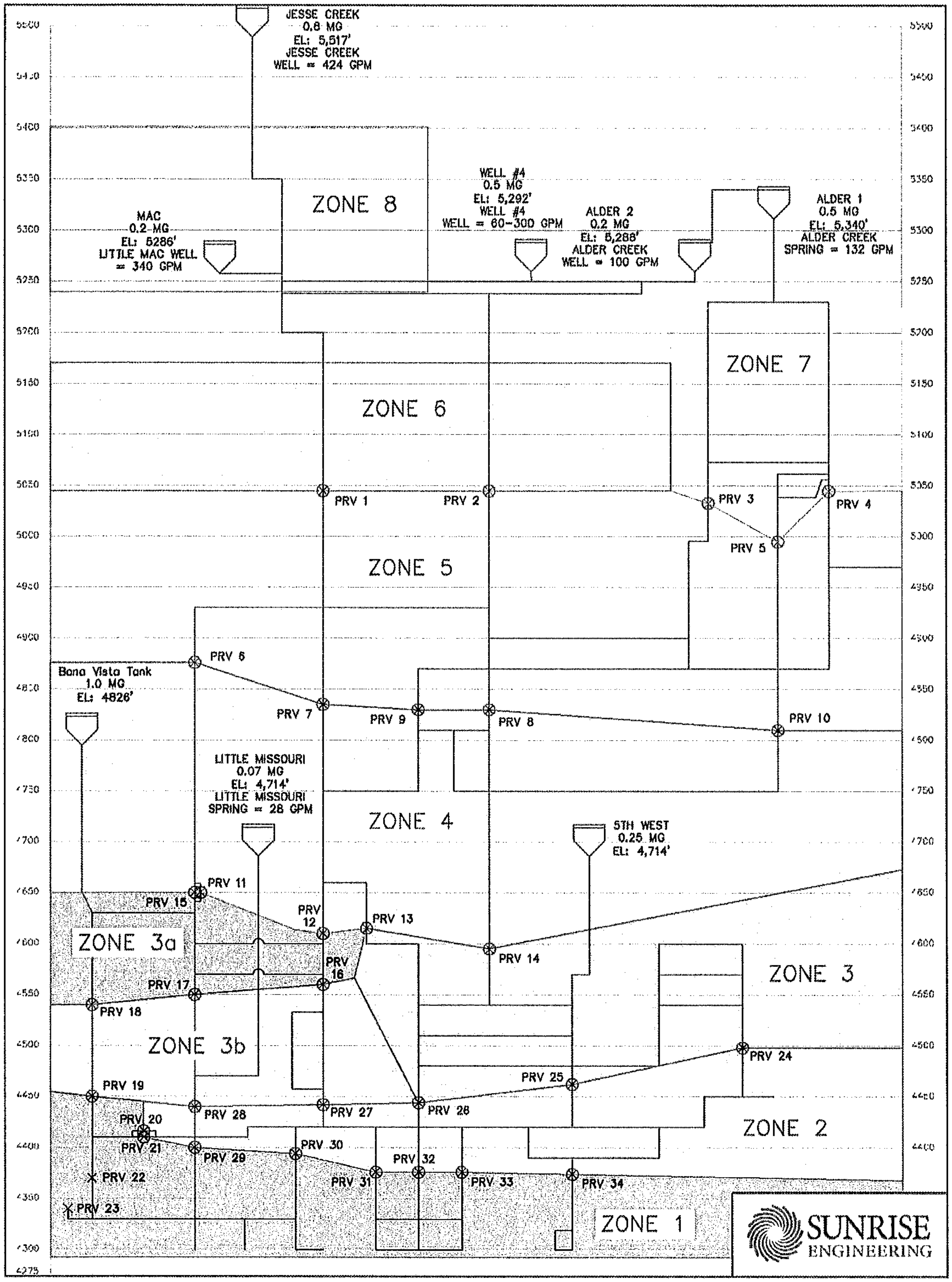


Figure 7.1- Bona Vista Tank and Pumphouse

Figure 7.2 Hydraulic Profile w/ BV Tank



SEI asked Bona Vista to look at two alternatives for conveying water to Pleasant View.

The first alternatice is to Wheel the water through Bona Vistas distribution system and have the point of connection off of the 16" transmission line which would able to serve Zone 3a and below within Pleasant View's water system. In this option Bona Vista would retain ownership of the pump house, transmission line, and tank. Pleasant View would need to construct a meter station and transmission line into its system. A wheeling agreement would include storage, distribution, peak demands and other components. Bona Vista provided costs for this option however, the board is not interested in pursuing this option and prefers alternative. The costs for this option are found in the appendix, and for this report it will not be analyzed further.

The second alternative is for Bona Vista to sell to Pleasant View the pump house, transmission line, and 1.0 MG tank with the point of service being the pump house. A small wheeling agreement would also need to be in place for the storage, distribution, and O&M to convey water to the pump house location. .

The opinion of probable cost and associated yearly fees with this alternative is shown in table 7.6.

Table 7.6 Engineers Opinion of Probable Cost WB Wholesale through Bona Vista

SUNRISE ENGINEERING, INC.

Opinion of Probable Costs

SUNRISE ENGINEERING

Project: Pleasant View City Source Feasibility Study — Project No:
Weber Basin through Bona Vista — Date:
Owner: Pleasant View City — By: Cliff Linford P.E.

ITEM NO.	Item	Quantity	Unit	Unit Price	AMOUNT
	Weber Basin Whole Sale Water Costs (Per Year)				
1	District 2 Water	300	AC-FT	$ 351.78	$ 105,534.00
2					
3	**Bona Vista Capital Purchase**				
4	1.0 MG Tank	1	LS	$ 450,000	$ 450,000.00
5	Pump House	1	LS	$ 348,998	$ 348,998.00
6	16" Transmission Line	3231	LF	$ 59.50	$ 192,244.50
7	12" Drain Line	2862	LF	$ 55.50	$ 158,841.00
8	Property (Pump House/Tank)	3.1	AC	$ 15,000	$ 46,200.00
9	Transmission Line Easement	1.48	AC	$ 7,500	$ 11,100.00
10				**Subtotal**	**$ 1,207,383.50**
11	Depreciation	**1**	**LS**	**$ (291,537)**	**$ (291,537)**
12			**Total Bona Vista Capital Cost**		**$ 915,847**
13	**Bona Vista Wheeling Agreements (Per Year)**				
14	Storage	1	LS	$ 9,187	$ 9,187
15	Distribution Capacity	1	LS	$ 4,200	$ 4,200
16	System O&M	1	LS	$ 5,000	$ 5,000
17				**Subtotal**	**$ 18,387**
18	**Pleasant View Transmission Line**				
19	12" Transmission Line	5500	LF	$ 75	$ 412,500
20	Connections	2	EA	$ 5,000	$ 10,000
21	Meter Vault	1	EA	$ 50,000	$ 50,000
22			**Subtotal Pleasant View Capital Cost**		**$ 495,887.00**
23	**Professional Services**				
24	Engineering Design	10%			$ 49,589
25	Construction Management	10%			$ 49,589
26				**Sub Total**	**$ 99,177**
27				**Project Total**	**$ 595,064**
23	**Pleasant View O&M (Per Year)**				
28	Power Costs	1	LS	$ 12,000	$ 12,000
29	System O&M	1	LS	$ 5,000	$ 5,000
30				**Subtotal**	**$ 17,000**

Table 7.5 below uses the opinion of probable costs above to determine $ per AC-FT and $/1,000 gallon cost of purchasing water from Weber Basin and wheeling it through Bona Vista.

Table 7.7 Cost of Water for WB Wholesale through Bona Vista

Component	$/Ac-Ft	$/Kgal
Weber Basin	$ 351.78	$ 1.08
Capital Purchase Bona Vista	$ 205.20	$ 0.63
Wheeling Agreement BonaVista	$ 61.29	$ 0.19
Pleasant View System Upgrades	$ 133.33	$ 0.41
Pleasant View O&M	$ 56.67	$ 0.17
	$ 808.26	**$ 2.48**

7.2.2 Weber Basin Whole Sale Direct

7.2.2.1 Weber Basin Whole Sale Pressure Zone 1

As discussed in Section 7.2, Weber Basin does not have a distribution system adjacent to Pleasant View City, however they do own a well in close proximity to Pleasant View City. The well known as the North Weber Well is located near the intersection of 2550 North and 750 West. The well pumps directly into Bona Vista's water system's Pressure Zone 1. In discussing the option with Weber Basin they would be willing to directly connect this well into Pleasant View City's water system and feed Bona Vista with other sources. The elevation of the well is approximately 4,300 ft and pumps 600 gpm at 70 psi. This would give it a hydraulic grade line of 4,462 ft. The hydraulic grade line of Pleasant View's pressure zone 1 (the lowest pressure zone) is 4,565 ft. In order to feed Pleasant View's system a booster pump station would need to constructed. Pleasant View's Pressure Zone Number 1 is in close proximity to the well (roughly 900 west and 2700 north). If the connection was made to the 8" line, the well would be able to feed Pressure Zone 1 from 1000 West to the west. The lines to the East of 1000 west are not connected to the western part of Zone 1 and would not be able to be fed from this well without additional looping in the system. See Figure 7.3.

A concern with this option is Pressure Zone 1 does not have the capacity to take all of Pleasant View's water systems build out demand deficiencies. Pressure Zone 1 currently has an average day demand of 298 AC-FT per year which is equivalent to 185 gpm and a peak day demand of 369 gpm. However, roughly 210 of the existing connections in Pressure Zone 1 are east of 1000 west connection and would not be able to be served by the Weber Basin Well. This would drop the average day demand to 126 gpm and the peak day demand to 253 gpm using the DDW water source sizing requirements. This would be even lower (95 gpm and 190 gpm) if the source reduction was allowed. For build out of this zone it is assumed that the well would be able to serve the entire zone with additional looping provided by new development. The build out tables shown previously demonstrates that an additional source would be required for build-out of the entire system since only (554 - 739.3 gpm) would be used in Pressure Zone 1 and the system has a projected deficit of 493 and 991 gpm respectively

Figure 7.3 Pleasant View's Water System Weber Basin Direct (Zone 1)

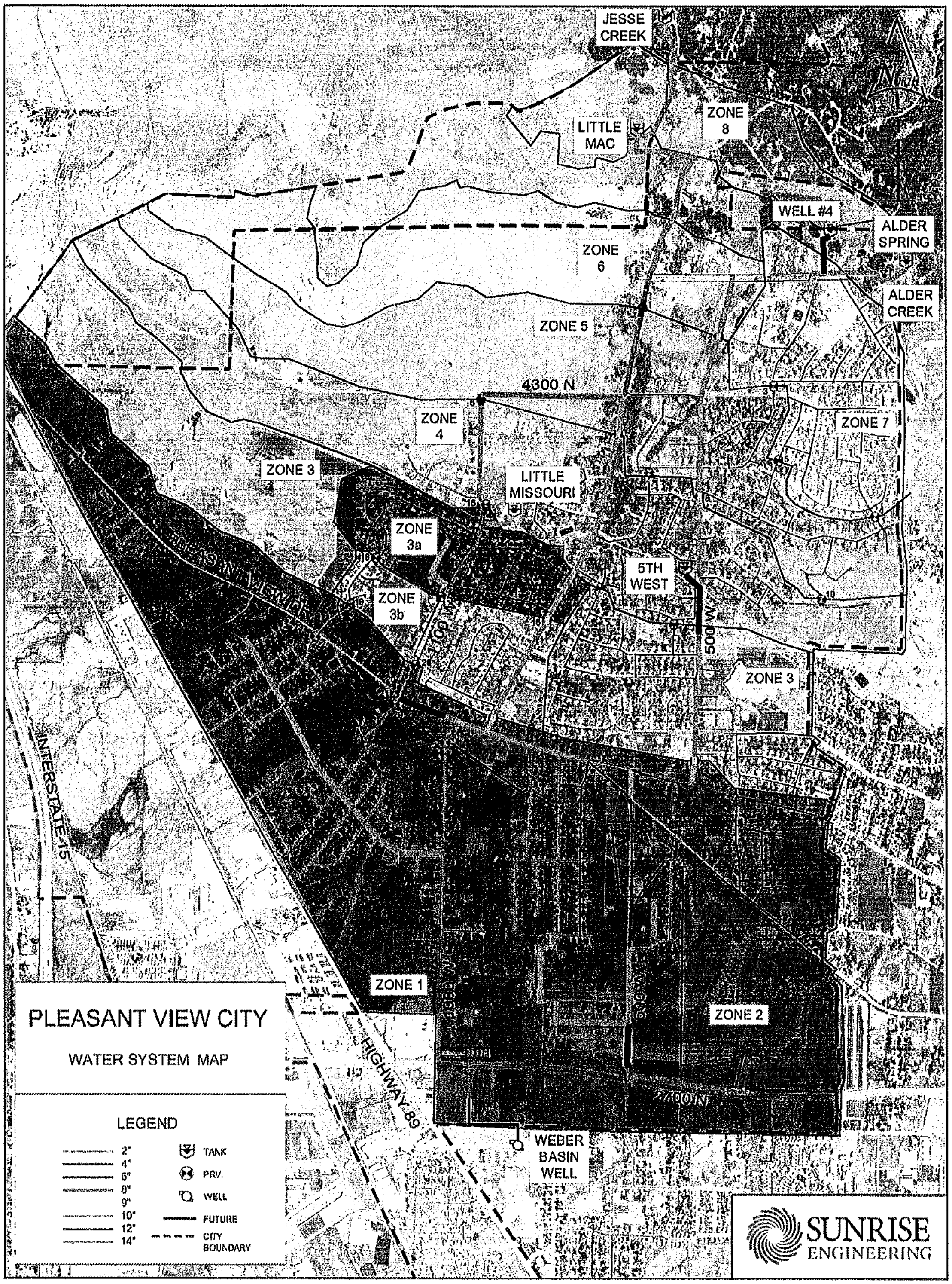
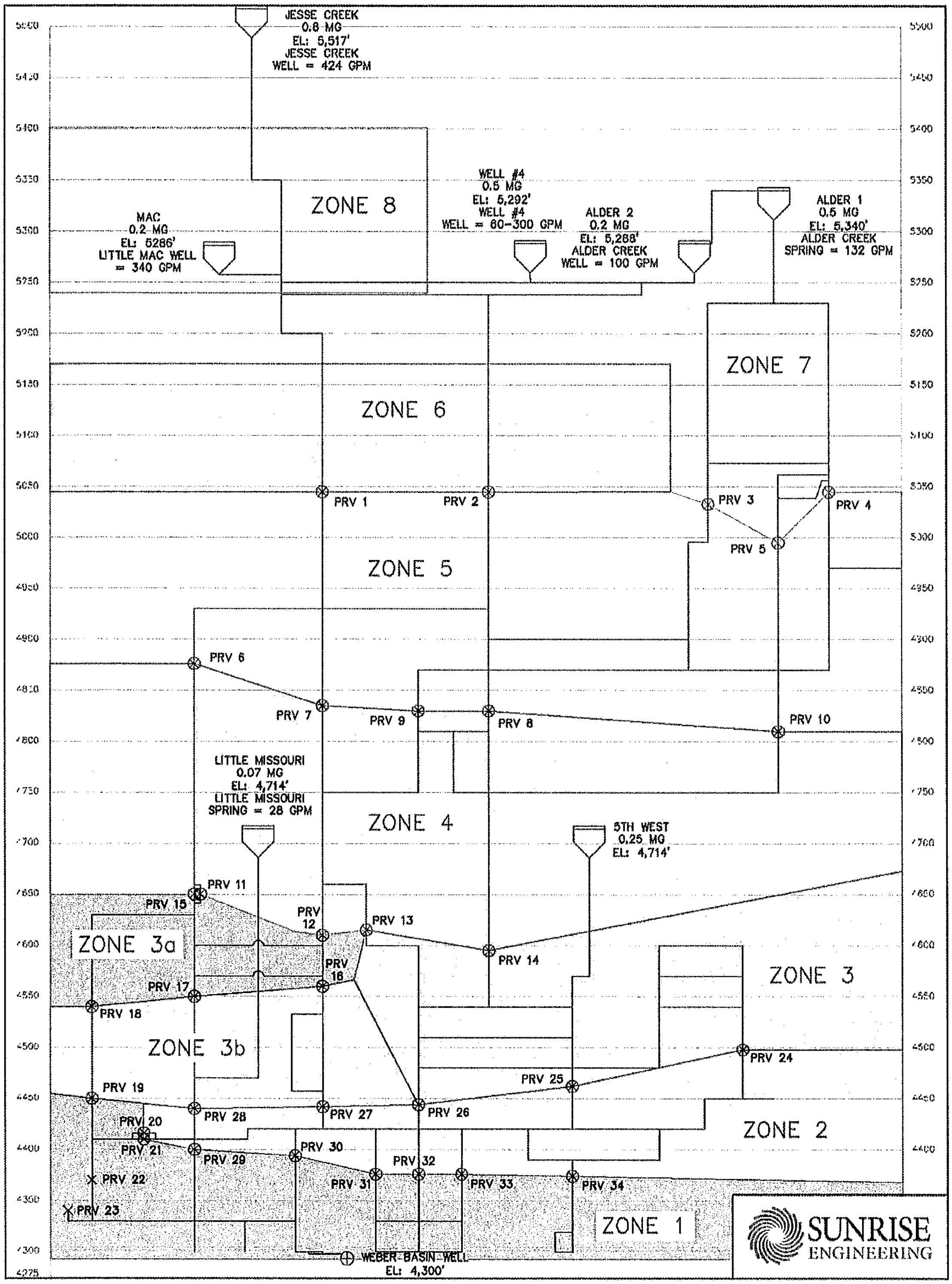


Figure 7.4 Hydraulic Profile Weber Basin Direct (Zone 1)



The opinion of probable costs and yearly fees for this option is shown in table 7.8,

Table 7.8 Engineers Opinion of Probable Cost Weber Basin Wholesale Direct (Zone 1)

SUNRISE ENGINEERING, INC.

Opinion of Probable Costs

Project:	Pleasant View City Source Feasibility Study	Project No:	
	Weber Basin through North Weber Well	Date:	
Owner:	Pleasant View City	By:	Cliff Linford P.E.

ITEM NO.	Item	Quantity	Unit	Unit Price	AMOUNT
	Weber Basin Whole Sale Water Costs (Per Year)				
1	District 2 Water	300	AC-FT	$ 351.78	$ 105,534.00
2					
3	**Pleasant View System Upgrades**				
4	Pump Station	1	LS	$ 300,000	$ 300,000
5	Transmission Line	2,000	LF	$ 110	$ 220,000
6	Meter Vault	1	EA	$ 50,000	$ 50,000
7				**Subtotal Construction Cost**	**$ 570,000.00**
8	**Professional Services**				
9	Engineering Design	10%			$ 57,000
10	Construction Management	10%			$ 57,000
11				**Sub Total**	**$ 114,000**
12				**Project Total**	**$ 684,000**
13	**Pleasant View O&M (Per Year)**				
14	Power Costs	1	LS	$ 5,000	$ 5,000
15	System O&M	1	LS	$ 5,000	$ 5,000
16				**Subtotal**	**$ 10,000**

Table 7.9 below uses the opinion of probable costs above and the assumed financing plan to determine $ per AC-FT and $/1,000 gallon cost of purchasing water from Weber Basin and wheeling it through Bona Vista.

Table 7.9 Cost of Water for Weber Basin Whole Sale (Zone 1)

Component	$/Ac-Ft	$/Kgal
Weber Basin	$ 351.78	$ 1.08
Pleasant View System Upgrades	$ 153.25	$ 0.47
Pleasant View O&M	$ 33.33	$ 0.10
	$ 538.37	**$ 1.65**

7.2.2.2 Weber Basin Whole Sale Pressure Zone 3

Since Pressure Zone 1 does not have the capacity to receive all the demand deficiencies for build out a second option for Weber Basin Direct would be to construct a transmission line to the 500 west tank and feed from pressure zone 3 down. The pump house would need to be larger to pump up to the 500 West tank and the transmission line would be 11,600 LF in length. See figure 7.4. The costs for this option are shown in table 7.10.

Figure 7.5 Pleasant View's Water System Weber Basin Direct (Zone 3)

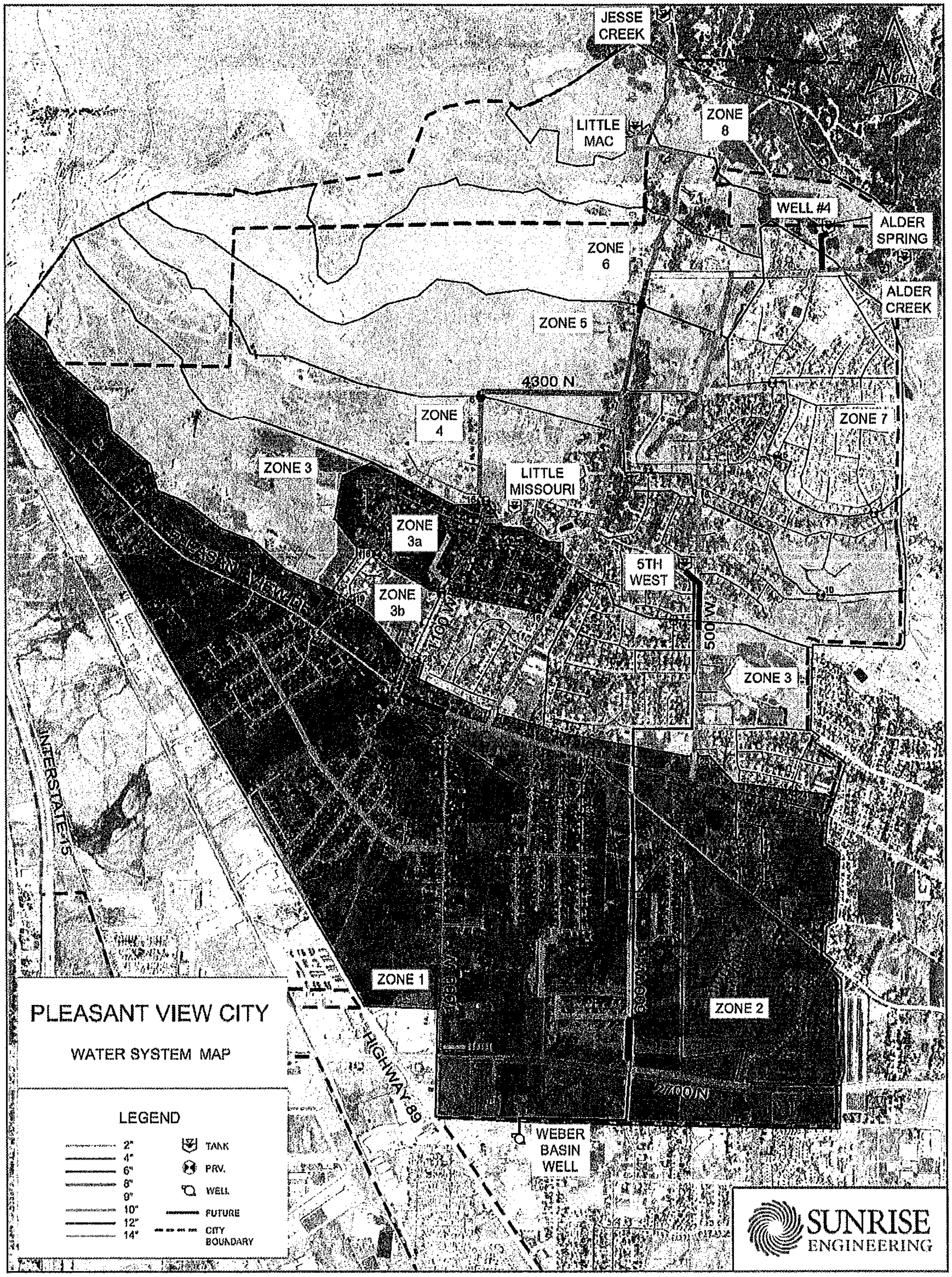


Figure 7.6 Hydraulic Profile Weber Basin Direct (Zone 3)

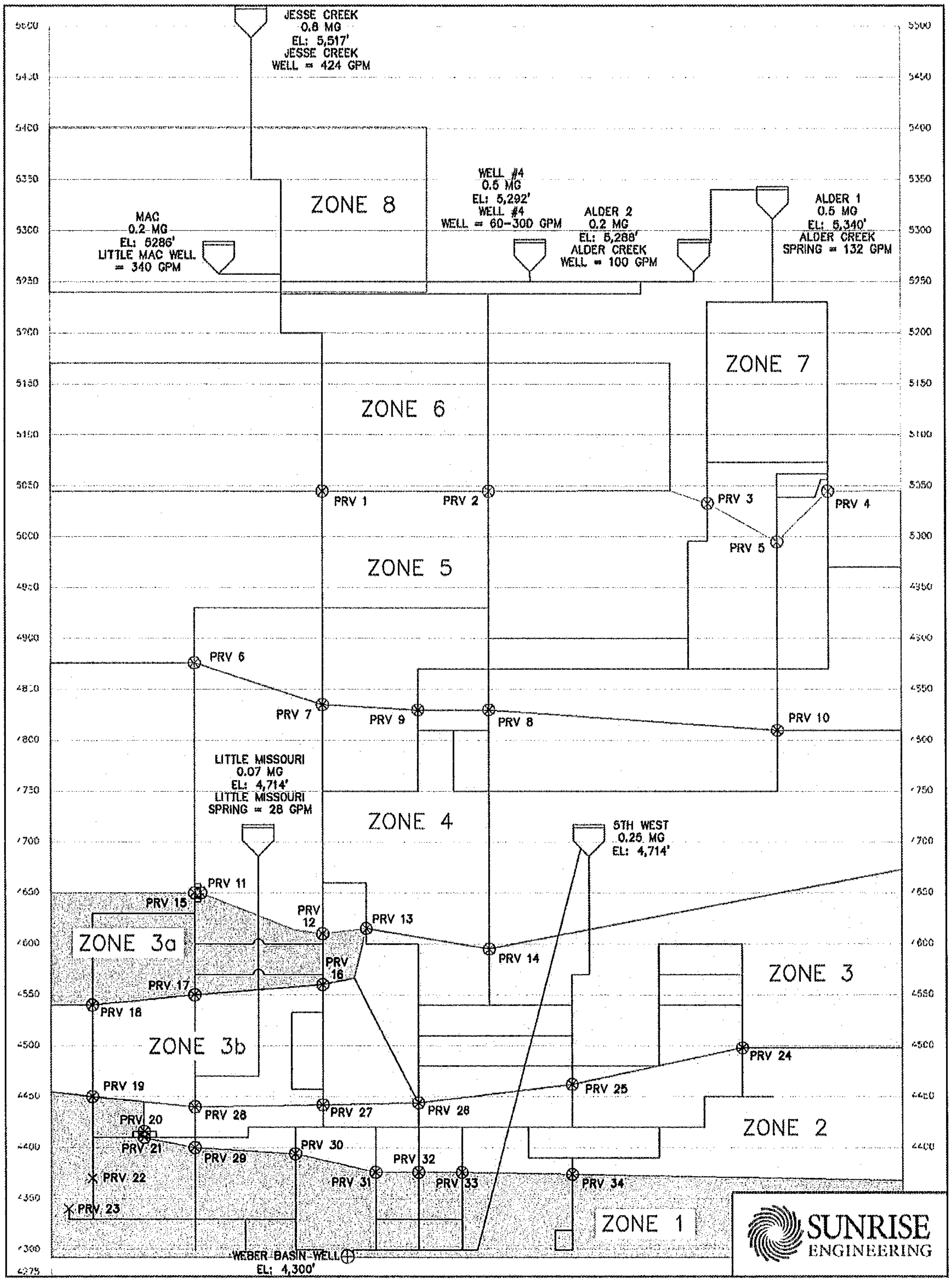


Table 7.10 Opinion of Probable Cost Weber Basin Whole Sale Direct (Zone 3)

SUNRISE ENGINEERING, INC.

Opinion of Probable Costs

Project:	Pleasant View City Source Feasibility Study	Project No:	
	Weber Basin through North Weber Well	Date:	
Owner:	Pleasant View City	By:	Cliff Linford P.E.

ITEM NO.	Item	Quantity	Unit	Unit Price	AMOUNT
	Weber Basin Whole Sale Water Costs (Per Year)				
1	District 2 Water	300	AC-FT	$ 351.78	$ 105,534.00
2					
3	**Pleasant View System Upgrades**				
4	Pump Station	1	LS	$ 400,000	$ 400,000
5	Transmission Line	11,600	LF	$ 110	$ 1,276,000
6	Meter Vault	1	EA	$ 50,000	$ 50,000
7				**Sub Total**	**$ 1,726,000.00**
8	**Professional Services**				
9	Engineering Design	10%			$ 172,600
10	Construction Management	10%			$ 172,600
11				**Sub Total**	**$ 345,200**
12				**Project Total**	**$ 2,071,200**
13	**Pleasant View O&M (Per Year)**				
14	Power Costs	1	LS	$ 12,000	$ 12,000
15	System O&M	1	LS	$ 5,000	$ 5,000
16				**Subtotal**	**$ 17,000**

Table 7.11 below uses the opinion of probable costs above and the assumed financing plan to determine $ per AC-FT and $/1,000 gallon cost of purchasing water from Weber Basin and pumping it into Zone 3.

Table 7.11 Cost of Water for Weber Basin Whole Sale (Zone 3)

Component	$/Ac-Ft	$/Kgal
Weber Basin	$ 351.78	$ 1.08
Pleasant View System Upgrades	$ 464.06	$ 1.42
Pleasant View O&M	$ 56.67	$ 0.17
	$ 872.50	**$ 2.68**

7.3 Source Feasibility Summary

All the options for additional source for the Pleasant View Culinary Water System are relatively expensive in comparison to other sources along the Wasatch front. However, each of the options analyzed in this report are a viable option to achieve additional source. Table 7.15 below summarizes the costs of each individual option and also compares the options to current retail customer costs. The current retail customer costs took the 2014 usage data and with the current rate structure calculated the cost per AC-FT and $/Kgal. It is important to note that retail customer costs includes the base rate of $10.00 per month. It is also important to note that all the options that have Weber Basin as the whole sale provider used tier 2 water at $351.78 per acre-foot. Tier 2 will not be available after this year and tier 3 water increases to $531 per acre-foot. If none of the Weber Basin options are selected this year than each of the Weber Basin options would increase by $179.22/AC-FT or $0.55 per Kgal, if selected in the future.

Table 7.15 Financial Summary of Source Options

Source Options	Capital Cost	Annual Costs	$/Ac-Ft	$/Kgal
Pleasant View Well (Upper)	$ 1,574,620.00	$ 17,000.00	$ 409.46	$ 1.26
Weber Basin Direct Zone 1	$ 684,000.00	$ 115,534.00	$ 538.37	$ 1.65
Pleasant View Well (Lower)	$ 2,110,192.00	$ 20,000.00	$ 539.46	$ 1.66
Weber Basin Bona Vista	$ 1,510,911.40	$ 140,921.00	$ 808.26	$ 2.48
Weber Basin Direct Zone 3	$ 2,071,200.00	$ 122,534.00	$ 872.50	$ 2.68
Residential Retail			$ 729.37	$ 2.24

Each option has its advantages and disadvantages. The upper zone well option is the cheapest option to acquire new source. The lower zone well is the third cheapest option and is comparable to Weber Basin Direct Zone 1. The disadvantage to drilling wells is that they are not a guaranteed source of water or at what flow rate you will be able to achieve. An attempt has been made in the cost analysis to mitigate this risk by budgeting for (3) test wells prior to drilling a production well. Also the projected flow rate on the new well was fairly conservative at 200 gpm. An advantage to drilling a new well is it may produce a significantly higher flow rate for the same capital cost reducing the overall cost of water significantly.

The second cheapest option is to connect directly into Weber Basin's North Weber Well and connect into Zone 1. The disadvantage to this option is Zone 1 does not have enough of a demand to use all the projected water deficiencies, meaning an additional source would still need to be acquired for build out conditions.

The Weber Basin through Bona Vista option has a number of advantages in the fact it is a guaranteed source of water and would be able to provide enough water to meet build out conditions. In addition it would supply an additional 1.0 MG of storage into the system for emergencies. The biggest disadvantage is the costs are significantly higher than the previously mentioned options and has the highest annual cost.

The most expensive option is purchasing whole-sale water directly through Weber Basin and pumping it up to zone 3, due to the length of transmission line required. Similar to the Bona Vista option it is a guarantee source of water, except if the well is down for repairs. It also has a slightly lower annual cost compare to the Bona Vista option but a higher capital cost.

With any of the options selected it is in the best interest of Pleasant View City to pursue a reduction from the minimum source requirements required by the DDW.

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